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The Royal School of Mines, Jermyn Street.

Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

Lecture XXX.—In our last lecture (said Mr. Smyth) we glanced at some of the conditions affecting the choice of position, and other important matters concerning shafts. With regard to metalliferous deposits, we have seen that a great variety of circumstances have to be considered in determining whether the shaft shall be sunk on the lode or perpendicularly, and so reaching it at a greater or less depth. If the lode is of no larger a width than 3 ft. or 4 ft. it is often expedient to work down on the lode, a strut here and there being sufficient in suitable rocks to keep the hanging-wall up; and if the lode becomes pinched up then a portion of the walls would have to be removed to keep the shaft of equal width. When a lode is very wide the shaft may be sunk on it, but if taken out to the full width there is great danger of a catastrophe, such as that which has befallen the St. John del Rey Mine, in Brazil, in spite of the vast and expensive stull-pieces which were used. When these large lodes are softer than the country it may be necessary to sink the shaft in the country at the side, and make frequent cross-cuts for exploration. We have also seen that with regard to shape there is great variety. In the coal fields of the North of England and elsewhere the shafts are all either circular or elliptical, while in metalliferous mines they are usually rectangular—although, of course, exceptions are to be found to this general rule. In Belgium and France many of the pits are polygonal, varying from eight to twenty sides. When shafts have reached a great depth, and are completed, no person looking through them, or examining them cursorily, would imagine the vast difficulties often encountered in their sinking, and still more in securing their sides. At starting, unless the ground is specially difficult, as it would be if composed of a loose watery gravel, but taking what is usual in the coal measures, and having to sink through clay-slate, shales, and the like, as soon as a few feet have been dug out it is necessary to put in a temporary kind of timbering to keep up the sides; but much must be left to the judgment of the engineer as to the selection of the spot in reference to the actual surface of the adjacent neighbourhood. Thus, if there is a probability of water flowing down from the surface, or if the ground is composed of sand, or of peat, or of any other material through which water penetrates, it is very desirable to cut a trench at a little distance around the shaft to drain off the water. To start the shaft in the proper direction some temporary trestles are erected, and on them is stretched a line, which may be got on the true run of the lode, by sights or by compass, when the lode cannot be seen at the surface. It is especially important to set out the engine-shafts, and indeed all shafts, true, but where they go down with the lode it is by no means an easy task. [The lecturer here drew many diagrams to illustrate his meaning, and gave rules by which the right direction at starting might be determined.] Having got the shaft set out true, the next thing is working it out. This is done by shovel-work, pick-work, hammer and gad work, blasting, &c. The work of sinking shafts is accompanied with certain dangers to the men, which ought always to be provided against. The men are confined in a narrow area, with only just room to work, and from which there is no escape if any heavy substance should fall upon them from above. They have, as they reach any considerable depth, to deal very frequently with serious incursions of water, which may weaken the sides, and dislodge masses of material; and some arrangements have frequently to be made to assist the natural ventilation. It is very seldom in metalliferous mines that a good captain will attempt to sink to any considerable depth without taking particular care to protect the men from any materials which might fall down the shaft; hence it is usual to construct over them what is called a "penthouse." This consists of a number of strong pieces of timber, placed crosswise in the shaft, filled in with planking. A small opening is left in this covering to admit of the passage of the bucket or kibble used in the sinking operations, and also for the men to pass through. To carry out the system of penthouses satisfactorily, it is usual to put a small windlass, so as to raise the material excavated as far as the penthouse, and afterwards raise it to the surface by the machinery at the top of the shaft. This is very much in opposition to the plan ordinarily adopted in sinking the vertical shafts in stratified deposits, where it is seldom that precautions of this kind are taken, and where a yawning shaft, perhaps 200, 300, or 400 yards in depth, is by no means an uncommon sight, without the slightest precaution being taken to keep away interlopers and strangers, or protect the men below from the fall of a plank, or tools, or rubbish, or other like dangers. The next point to be considered is the best mode of protecting the sides by means of timber. Although ultimately you might desire to put in bricks or stonework, it is generally necessary for temporary purposes to employ timber, and in most metalliferous mines timber is allowed to remain as a means of protection. In the case of a shaft like that of the Tresavean Mine, which I have before mentioned, going down to a depth of 310 fathoms, and which has been sunk in the hard solid granite, it will endure for years without any artificial protection; but even granite, when it is jointy, where strings pass through it, where it is decomposed, or where it is intersected by cross veins, may be far from secure. Then, again, at the Samson Mine, at Andreasberg, there is a shaft which inclines first in one direction, then becames perpendicular, then it inclines in an opposite direction, and again follows the perpendicular. Here, too, strata have been passed through, of which as much as 100 fms. required no timbering, whilst other parts of the same shaft taxed all the resources of the timberman to render them secure. It is very desirable at the outset, if the shaft is to be timbered from the surface, you should lay out the plan of the shaft very definitely, and get your angles correctly. If, for instance, you were about to sink a rectangular shaft, it would be necessary to employ plumb-bobs at the angles, so as to preserve the planes of the shaft perfectly consistent throughout. The manager should not allow the sinking to go on for many feet together without testing whether the angles are being kept perfectly true, and although at first sight it might appear a very simple matter to keep them so, there are very few shafts indeed where an active and constant supervision is not exercised during the progress of sinking, which do not swerve from the perpendicular line either to the one side or to the other, and sometimes on both, to an extent almost inconceivable. The consequence of such a state of things is that when they come to put in powerful pumping machinery they find the main rod working against the side. To remedy this, fathoms and fathoms of ground sometimes have to be cut away, the operations are delayed, and occasionally it is a question whether the workings can go on at all. It is, therefore, far less expensive to sink a shaft perfectly true than by carelessness to incur such a great outlay in remedying mistakes. If we have the shaft sunk in the proper place, in the best way, and true to the perpendicular, its size and scale will determine the size of the timbering required. Of course, a merely exploratory shaft to test the position of a vein, or in stream works for tin and gold, no greater securities than those used in military mining would suffice. In such cases a framework of four pieces of 6-in. timber, with the ends projecting 2 ft., the timbers being let into each other so as to lie tolerably flat, is put down on the surface. They then commence to dig downwards a few feet, when it may be necessary to put in another framework of timber of the same dimensions as the shaft, without the projecting ends, and so at intervals all the way down. In the hematite mines in the North of England, where the ground is apt to collapse and come together very rapidly, a convenient kind of framework, known by the name of "dutch cases," is made use of. These are composed of wooden frames, like those I have just described, with planks fastened down at the sides from one to the other. This plank framing is also much used in parts of Scotland, and in some of the softer beds in the West of England, but it ought never to be attempted where the shafts are at any great depth. Where timbering is intended to remain, its size and strength should be proportioned to the diameter of the shaft. In many cases, when shafts are intended for more than temporary purposes, the timber may only be intended to remain until a good foundation is reached, when it will be replaced by stone or brickwork. Framework of this description varies very considerably, not only as regards the shape of the shaft, but on account of the great difference of the material through which it passes, and which it is necessary to keep out. In strong ground it might be sufficient to simply cut holes in the side, so as to form a ledge on which to rest the bearers, but if the ground be loose it will be needful to take especial precautions to put in strong planks and spilling pieces, and to be careful to secure the footings or bearers before anything is placed upon them.

Lectures XXXI and XXXII.—The short description I have given of the work of timbering and securing of shafts will have shown that it is an important part of the mechanical portion of mining; since not only is it a matter of great expense, but if mistakes are made they are pretty sure to lead to serious results, and, perhaps, entail the necessity of stopping the entire traffic of the mine, even if no fatality from accident should occur. This is a matter of the highest importance in dealing with collieries or other mines, where everything depends on a regular quantity of mineral being raised daily to the surface, and in which, therefore, a stoppage of only a few days may be extremely detrimental to the interests of all, whether proprietors or workpeople; and no expense, therefore, ought to be spared as regards timber. There remains, however, still one matter affecting the shafts to be referred to. It is desirable at the bottom to institute magazines of mineral, or places in which, in the case of metalliferous mines, the mineral brought from the workings may be stored for at least a certain number of days. In ironstone and coal mines the case is different. There the beds worked are probably not more than two or three in number, so that the arrangements are made with a view that when the wagons come to the shaft bottom they are raised at once, and the machinery employed should be so proportioned to the quantity brought to the bottom of the pit that there shall be no accumulations there. Thus it frequently happens that, where the machinery is of a powerful calibre, as much as 1500 tons may be raised in a day from one pit; and as much as 800 or 1000 tons is by no means unusually raised, without clog or difficulty. On the other hand, great difficulties often arise in metalliferous mines for want of good arrangements of this kind. Suppose, for instance, we are dealing with a shaft which has twelve or fourteen different levels into it, and in each level, as there frequently are, four or five different working places, what is to be done with the ore or material got out, for it will accumulate, particularly if the ground be soft, while the men are at work faster than one or even a pair of engines could wind it up? It is, therefore, necessary to have these store places in which the excavated ore can be put out of the way until it can be drawn up the shaft. It is a slovenly practice, but it often occurs, to allow the men to place the material along the sides of the level, sometimes filling up fathoms and fathoms in length, until the level is so blocked up that it is impassable except by creeping or crawling, and the ventilation is very much deranged and impeded in consequence. It is, therefore, highly important in metalliferous mines to provide proper places for the storing of the material excavated, and so prevent the men from suffocating themselves by slow degrees. Perhaps in no mine is this matter better attended to than in the Devon Great Consols Mine, where the whole of the levels are kept perfectly clear from any obstruction, and where at each level proper arrangements are made for the collection and storage of the material temporarily. This is done by means of a "trip-plat," or magazine, at the head of each level. The trip-plat is formed by cutting the level at the end nearest the pit, with a story below it; so that from the roof to the floor for a short distance the space is twice as great as that of the level as it recedes from the pit. Then over the deeper portion rails are laid, supported by props, and into the hollow spaces or story beneath the material taken out of the level is tipped. The opening of plats in certain kinds of ground is a very difficult operation, and it is always necessary to put in timbering to preserve the sides of the shaft intact. In the Hartz, where they do things on a large scale, they have extensive plats, and so are able to divide the attle from the ore in these temporary stowages, which are made in three stories for that purpose. [The lecturer, by means of the board, drew a large number of diagrams exhibiting trip-plats of various kinds, and the means used to render them secure.]

I have only a word or two to add on the subject of timbering. Where pressure only has to be resisted it holds its own very well, but where it is subject to alternations of wet and dry, as within a few yards of the surface, and to peculiar states of atmosphere, it is greatly subject to rot. For this many different cures and preventives have been proposed. It was observed that where timber was placed in water, impregnated with some of the sulphates and other chemical bodies, its duration was greatly increased; and it was, therefore, proposed to saturate at the surface the timber to be used below, but most of these recipes proved too expensive. It had been found that where the water contained sulphates it was a good plan, and especially where the timber is exposed to a warm atmosphere, to let little rivulets keep the timber continually wet; and in the Hartz this is done by small jets, which fall like rain, and trickle down the timber. The practical result of all is, however, that it is necessary to secure both the shafts and levels with a more permanent material. One disadvantage of securing shafts near the surface by timber only is that after a mine has been abandoned for some little time, and even if a shaft has been left idle for a time, the ground thus supported may give way, and the mouth of the shaft becomes extremely dangerous. There is always more or less loose ground at the surface; and, whether the mine be situated in a country like this, where there is a constant rain-fall throughout the year, or whether it were in a tropical country, which is subject to large floods at particular seasons, channels of water constantly form themselves at the surface, and the water runs down the sides of the shaft. The consequence is a subsidence of the material forming the sides of the shaft, which displaces some of the timbers; and, others following, the shaft for a considerable distance in depth goes to ruin, and becomes a vast crater, equally dangerous to man and beast. In order to avoid this, and the constant expense of repairing the timbering, it is very desirable that the upper part of the shaft should be secured either by spilling or walling. The latter is generally adopted in metalliferous mines, and where stone of suitable description is abundant, with a good foundation, it will last for centuries. Supposing, then, it is decided to put in walling to a certain depth, it is usual first to line the upper portion with timbering of a temporary kind, until they get down to a secure foundation for the masonry on a hard rock. Then, having previously cut the shaft a little wider than necessary, they commence to form it of the net dimensions required, and build up the wall of stone or bricks, taking away the temporary timber piecemeal as they advance, until they completely wall in that portion of the shaft. But it frequently happens that they cannot get a good foundation for the walling, or that portion of the shaft may be in the lode itself, and that, therefore, the very working away of the lode may cause portions of the side to come away, and render it impossible to get a foundation. In these cases the walling is supported on cross timbers; but, of course, that would only last as long as the timber endured, hence that would not be considered satisfactory for shafts intended to be kept open for any length of time. The next plan was the obvious one of substituting an arch for the pieces of timber, which ought to be adopted very much more frequently than at present in metalliferous mines. It is the system upon which a great deal of excellent work is carried out in Saxony, and also on a smaller scale in other districts. When the sides of the shaft are more or less yielding, it is usual to arch all the four sides, like a parallelogram. That comes very near, in fact, to the elliptical or circular shafts ordinarily employed in collieries. The mode of walling adopted in the latter forms of shafts will be more or less similar; but, in proportion to the difficulties met with—such as quicksands, or ground which allows water to come in—work of a more exact kind has to be resorted to. Suppose a circular shaft were intended to be 12 feet diameter in the clear, the engineers would begin sinking with dimensions considerably larger. First of all, a couple of strong baulks of timber would be laid across the ground at the surface, capable of sustaining very heavy weights, as, for instance, the timbering which would be put in subsequently, the masonry, or the pump-rods for the draining of the shaft. They would then dig a short way down, and when a sufficient depth had been excavated put in a framework of timber; then, digging still deeper, other frames of timber would be put in at certain intervals, punch props being placed between them to keep them usunder until they reach a foundation. Supposing they did not find the natural rock strong enough, a temporary foundation of timber would be put in, and the process repeated, probably many times if the shaft were deep; and when at length a solid foundation is secured, those temporary ones would be taken out bit by bit, and replaced by permanent work. There are many modifications of this simple style of work, as, for instance, occasional curves projecting from the brickwork, as a precaution against a partial disturbance of the the shaft by the dropping of some particular part of it. In Derbyshire it is the custom to base the brickwork on square frames, which project at the corners a few inches into the ground. One of the most remarkable examples of a finely-constructed shaft is that at the deep sinking at Dukinfield, in Cheshire, where the work was admirably carried out. The brickwork is 9 in. thick, of bricks formed especially to fit the sweep of the curve, and set in the well-known Hardwicke hydraulic lime, which is found in that neighbourhood. At intervals of about 8 yards curves of stone are put in, 18 or 20 inches wide, and 12 inches in thickness, projecting into the measures. It might be necessary, even when sinking in not very difficult ground, when they could not wait until they reached a good foundation to suspend the timber framework which sustains the brickwork from the baulks at the top of the opening, but this was, of course, only a temporary expedient.

Lecture XXXIII.—Having said so much with respect to securing shafts by means of timbering and masonry, the latter being the mode ordinarily employed in the collieries of this country, and the next stages—those connected with the laying of the curves which, as I have said, are placed at small distances asunder, supported one upon another until a firm foundation is attained—we pass to the consideration of cases where the shaft has to be lined with almost an incredible degree of skill and care in those who have the work to do. This is called "tubbing" the shaft against the watery beds through which it passes, and it is an operation which may be performed in a great variety of ways. It will be well, first, to point out a few of the cases in which the system of "tubbing" or "coffering" becomes applicable, because it is a method which, although involving a great expense at first, nevertheless, where it can be applied, it is so admirable a means of avoiding ulterior expenses, that it is most important that every mine manager should be perfectly competent, not only to judge of the circumstances under which it may be advantageously employed, but also to select that method, and that kind of tubbing, and that preparation of its different constituent parts which will enable him best to combat the difficulties of his particular mine. I will take the case of a shaft having to be sunk in ground of a porous nature, more or less approximating to quicksands, such as where we have the former bed of a river to deal with. Now, if the depth to which we have to sink be very shallow, it is a matter of very little difficulty, with either wood, stone, or brick work, to keep out the water; but when we get down to a depth (say) of 50 or 60 feet, and have to contend with the great pressure due to a column of water of that height, we should necessarily have at the bottom of the shaft so great a pressure as to cause very great difficulty in keeping out any water that finds its way through the chinks of ordinary timbering, however close it may be put in. The way to keep out the water is to put in a water-tight joint at the base of the watery ground, in such a way that the water could not get past the joint. This is a matter of considerable difficulty; but supposing that we had effected it, we might then continue sinking, and probably get into a rock which was water-tight, and so complete our sinking without the necessity of pumping. But if, as is frequently the case, we get down to measures—coal measures I will suppose—dipping at a certain angle, and which is reached at a point where they are intersected by a water-bearing bed, we then come upon a source, probably, of great difficulty. Suppose that water-bearing bed were intersected by the shaft, we must of necessity commence by pumping that out, in order to allow the men to continue work; and then arises the question of the depth and character of the bed, and whether we may not be able to keep the water out by some system of tubbing. This might, no doubt, under favourable circumstances be effected by sinking a shaft through the water-bearing bed, to begin with, down into a water-tight portion of the ground, where putting in such a foundation as I have before referred to, and making it perfectly firm, we might build up all round the shaft tubbing—that is, just as a tub is made to contain water within it, so tubbing is constructed to contain water outside, or, rather, to prevent it from coming in from the sides. Then, having put in tubbing though the whole of the water-bearing bed, another water-tight joint must be put in at the top of the tubbing, and so the water will be kept out of the shaft, and we may continue our sinking in dry ground, or with but little filtration of water. If, unfortunately, we meet with an alternation of water-bearing ground, we should have to repeat the same process of tubbing. Then, if fortune favoured us, and we got a perfectly secure shaft, we may open out a large colliery, without the necessity of employing pumping machinery. The water-bearing beds may occur frequently with dry strata between them, or in one continuous length of ground; and we may sometimes sink comparatively very dry for some distance, and then come to an enormous feed of water. The mode of dealing with cases of this kind would not differ materially from those I have already spoken of, but sometimes it will be necessary to join one length of tubbing to another, and hence a great part of the shaft may require tubbing. Great difficulty has been experienced in sinking through the Permian rocks, or magnesian limestone, in the eastern portion of our northern coal fields. The rocks of that formation contain a certain amount of water, though not very considerable, some being much more watery than others; but when we approach the bottom of the magnesian limestone we come upon what are called the Lower Red Sands, which are sometimes of considerable thickness, but are, generally speaking, so saturated with water that it comes in a perfect flood, and gives rise to great difficulties. If the magnesian limestone were very loose in its texture there would be a great quantity of water all the way down, and, therefore, in sinking through that kind of strata it is necessary to put in a temporary foundation, at a shallow depth, to carry the tubbing from that foundation upwards as far as requisite, then to sink to a greater depth, until a place suitable for a second foundation is found, from which tubbing can be put as far as the first foundation, and the operation repeated until the sinking is completed. Great difficulties have been met with in the sinking of colliery shafts in the northern coal field, in Belgium, in the North of France, and in Westphalia, in certain beds of the chalk series, and especially in some loose watery beds at the lower part of the cretaceous system. It was necessary to surround the pit whilst sinking with a group of steam-engines, having a total power of from 1800 to 2000 horses, to pump the water out, whilst the men were enabled simply to get down until they could establish a water-tight foundation. If a force of a 1000 horse-power had to be employed, it would be quite impossible to carry on a mine economically, and yet this was only a moderate amount compared with what was requisite in some cases. In the famous sinking of Murton, in the North of England, it was attempted to sink two shafts, of 14 feet diameter each. At that operation the engine power consisted of no less than three engines, of 120 horse-power, intended ultimately for winding; one engine of 120 horse-power, intended to be the pumping engine; besides a number of smaller engines; and each of these had attached to them sets of pumps of from 16 to 19 in. diameter. The quantity of water raised was as much as 3285 gallons per minute, and yet this was hardly sufficient to combat the feeder met with. If a feeder were met with at considerable depth, of course the difficulties were greatly increased. At Murton the depth of that watery stratum was 76 fms., the depth at which the bottom of the magnesian limestone was reached; while at Monkwearmouth it was only 52 fathoms; and at South Hetton, another famous colliery sinking, also through the magnesian limestone, it was met with at 64 fms. In many cases a comparatively short length of tubbing might suffice, but in others it is necessary, after sinking to a considerable depth, to put in a much greater length than had probably been intended at the outset. One point which has to be considered before tubbing is resorted to is the pressure with which water finds its way through the fissures of the rock; therefore, if a watery bed be met with at a great depth—for instance, 200 yards—it is important to note whence the water came from. It might be that it came from hilly ground, giving rise to so large a column of water, and such a pressure that very strong tubbing would be required to keep it back. If the country beyond were flat, the column of water would not be so strong, and tubbing of a weaker description would suffice. Sometimes it is possible, by examining the surface, to cut off some of the water at the outcrop of the seam.

The materials employed in tubbing are very numerous. Brick or stone walling, with hydraulic lime or cement; wood, which is still commonly used in Belgium and France, and formerly in our northern coal field, as well as cast and wrought iron, have been employed for the purpose. Much may be gleaned in reference to the sinking through the magnesian limestone in the northern coal field from the Transactions of the North of England Institute of Mining Engineers. One of the simplest methods of tubbing is that of sinking shafts of brick or stone work bodily; and it has been very satisfactorily carried out in many cases, where the brick work is based on a curve, with a lining, or edge-plete, of cast-iron strongly affixed to its lower part. Upon this would be commenced the brick or stone work to be sunk in the ground, by means of beams laid across it, weighted down with other materials; and as the masonry sinks the soft material which rises up in the middle is excavated, and in this way a great depth of masonry may be sunk bodily. It is very necessary to look to the verticality of the sinking by this method, as this is apt to be interfered with by inequalities in the ground, such as the meeting with stones, &c., which it becomes necessary to pitch out. This plan has been more particularly adopted in Westphalia; although in some instances, notwithstanding the heavy expense incurred, many of the sinkings failed when the pumping engine had been stopped, and the full pressure of the water came to bear upon them. The form chiefly adopted in Westphalia is the four-sided shaft, the sides being curved, so as to be almost circular. Sometimes stone is employed, and at others bricks, and the following calculation has been made:—If the bricks were 1½ inches in length, when the pressure, or depth, was 15 fms., the sides must not be less than 2 bricks; if 28 fms., it should be 2½ bricks; if 45 fms., 3 bricks; if 55 fms., 3½ bricks; and if 60 fms., 4 bricks. The results, however, obtained by walling are not so satisfactory as other kinds of tubbing. Although the employment of wood in the operation of tubbing was found preferable to walling, it has been almost entirely superseded by the use of cast-iron. Wrought-iron has not been employed very extensively, there being but few examples of its use at great depths; nor, on the whole, has it been found to answer very satisfactorily, as in some instances it has yielded to the pressure, and its sides been forced into the shaft. The fact is, cast-iron can be obtained in this country with such facility, in any form and of any weight, that almost every other material has given way to it. Solid wood was once used to a small extent in this country, but very much more extensively in Belgium and the North of France, where it was preferred on account of its economy. One remarkable instance of its use

occurred in the prolongation of the great coal field of Saarbruck, at Carling, in the department of the Moselle, where tubbing composed of solid wood has been put in to a depth of 160 metres, in one continuous length, and the results have been very satisfactory. A great number of the shafts in the neighbourhood of Charleroi, Liége, &c., and, in fact, over a great portion of Belgium, are tubbed with the same material. In this operation a wedging curve, locally termed a "trousse collete," is employed, which is doubled in places where considerable pressure was anticipated. In order to make a thoroughly water-tight joint between the curve and the rock, it is necessary to wedge them very closely, by putting in a series of wedges at the back of the curve, and between its several joints. Iron tubbing has been very largely employed in the water-bearing beds of the northern coal fields of England. About the commencement of the present century it was proposed to sink large cylinders of iron into the ground, for the purpose of forming shafts, and this was a very feasible method of sinking small shafts. But on attempting to sink large shafts by this means, it was found extremely difficult.

It has been suggested that the tubbing might be cast in segments, and taken down the shaft separately, and then screwed together; but this plan, although carried into effect, was not found very satisfactory. There was great difficulty in getting the segments to fit true, and when the pressure came to act upon this form of tubbing it was found that the screw-bolts gave way. The first modification of iron tubbing mentioned—that of employing cylinders cast in pieces and lowered into the ground—was introduced at the Walker Pit, about the year 1795; the second plan, that of casting the iron tubbing in segments, and bolting them together in the shaft was introduced by Mr. Buddle in 1796; whilst the modern system of tubbing from a foundation at a certain depth in the shaft, was introduced by Mr. Buddle in 1804. The latter system is very analogous in the mode of putting it into the shaft to that adopted in the case of wood work, the greatest care having been exercised in the laying of the wedging curve for tht foundation. The wedging curve is laid in precisely the same way as in the case of wood, and it may be either single, double, or threefold, according to the requirements of the ground. Between the joints of the curve are laid thin sheets of deal, and at the back of these, and between all the segments, wedges are driven in as far as possible. The whole of the space at the back of the curve should be filled with wedges, so long as a space can be opened with a chisel between the fibres of the wood. Tubbing proper, which should previously have been cast in segments of convenient length, is then built upon the curve; between all the joints of the tubbing a plate of deal is placed, and at the back a brick wall is built, the space between which and the tubbing is filled as closely as possible with wedges. After tubbing the entire extent of watery ground, the whole of the segments must be bolted together, and the holes filled up that have been left at intervals for the discharge of the water into the sump whilst the tubbing is going on. Tubbing is made of variable thickness, sometimes as much as 1½ or 1¾ in. thick. Its strength, however, depends not only upon the thickness of the material, but also upon the height of the segments, which in cases where the pressure is not great may be made 3 or 3½ feet high, but where the pressure is considerable they must be from 2 ft. to 18 in., or 14 in. in height only. When the segments are very shallow in depth a much greater amount of labour is involved, as in the putting down of a wedging-curve alone in a pit of moderate diameter (12 feet), where three rows of curves are required, no less than 25,000 wedges have to be driven in during the operation. A very great improvement was made in cast-iron tubbing when the flanges were transferred from the inside to the outside.

LECTURE XXXIV.—The history of tubbing, such as that now employed, is one of comparatively recent date. At the end of the last century a species of wooden tubbing was employed, and it was found capable of resisting a considerable pressure; but it was not till 1804 or 1805 that cast-iron tubbing was experimented upon, and the nature of which I have sufficiently described. There are, however, one or two points to be added. Thus, in getting a water-tight curve at the base, which is indispensable, the nature of the ground may make it necessary to put in two curves instead of one, or, perhaps, a third. Again, the height and thickness of the cylinders must be varied according to the pressure they have to endure. Thus, if the pressure be moderate, the thickness of the cast-iron may be only ½ inch, and the plates 3 feet high; but with increased pressure it will be found that the height must be reduced to 2 feet, to 20 inches, or even to 12 inches, and the thickness increased to 1 in., 1¼ in., or 1½ in. of solid cast-iron throughout; besides which, if the pressure is extreme, the plates may be strengthened by flanges, both horizontal and vertical. Whether the pressure be great or little, if tubbing has to be put in it is important, in order to prevent accidents, that each plate should be carefully tested before going down into the pit. This will be done by striking the plate with a hammer, the blows being tolerably heavy, and the corners in the same way with a blunt chisel and hammer. The discovery of a flaw in this manner may save enormous trouble, expense, and difficulty afterwards, for it must be ever borne in mind that when once a plate is put into its place, and properly wedged up, it cannot be taken out without greatly disturbing the other portions of the tubbing. I also mentioned yesterday briefly the system pursued in Belgium and the North of France, where wooden blocks are applied in the place of plates. The shafts there are mostly polygonal, and the wedging curve having been put in, the back is filled in afterwards with closely-packed moss. The blocks are composed of carefully selected oak, free from knots or irregularities, made to fit accurately, a couple of pins on the upper blocks being made to fit into holes in the lower, prepared for their reception. The principles of the system are precisely the same; and it is said that shafts thus formed wholly of wood possess the advantages of greater durability than iron, and of a less cost. No doubt cast-iron is expensive, but its use is, nevertheless, a great boon to modern mining. Sometimes feeders are only partially stopped, but even that generally is an advantage, as it will enable the shaft to be worked. One of the most remarkable instances of tubbing is that of the Shireoaks Colliery, to which I have frequently alluded. The pits there are 515 yards deep, and the tubbing is in 11 lengths; the cost of the lower part was 126 cwts. of cast-iron, at 7s. per cwt., which, with the wedging out, laying rings at about 10 yards apart, and other expenses, made a total of 60l. 2s. per yard, by means of which 6400 gallons of water per minute were stopped out. There are many cases in which enormous amounts of water are thus wholly got rid of, and the works are carried on without having to pump a single drop.

In metalliferous mines the principle of tubbing cannot be advantageously carried out, except in very rare instances. When the miner has to deal with a series of deposits coming up to the surface, it is obvious, in such irregular operations, that it is only here and there that the water can be dealt with in this way. It is impossible to state, however, how frequently it comes into use in metalliferous mines in order to keep out the water of the superficial sands and gravels; and in this way a good deal may be cut off in the upper part of a shaft by a lining of boiler-plate iron. In the stratified deposits and coal fields, where they have to deal with the magnesian or Permian limestone, with the New Red Sandstone at the bottom of that, tubbing plays an important part. At the South Hetton Colliery it is 64 fathoms to the bottom of this limestone. At Monkwearmouth, where there is the deepest shaft in that part of England (280 fms.), it is 52 fms., and at Murton, where it gave rise to great difficulties, 76 fms. At such depths the pressure and the quantities of water which came in were enormous, and to employ the requisite pumping-power to get rid of that water would cost enough to swallow up all the profits of the mine. By means of tubbing, however, these difficulties had been overcome, and it will be seen at once that however costly that tubbing may have been it is, compared with pumping, an economic arrangement, and an immense boon.

One of the most interesting cases in which natural difficulties, apparently insurmountable, were overcome was that of shafts sunk in the valley of the Loire. This valley is underlaid with coal measures, which are covered with sands, gravels, &c. Shafts, lined with boiler-plates, were driven down by pressure, or careful impact, but it was found that just at the bottom of the pervious strata, where, in fact, the pressure was greatest, a bed of boulders came in and canted the shaft over, or prevented its progress. Pumping was impossible; it would have been as easy to pump dry the River Loire. The shaft was considered lost, but M. Triger, an eminent geologist and colliery engineer, was called in, and the idea struck him that the water might be kept out by the introduction of compressed air to counteract it. The pressure was one of so many pounds to the square inch, and the question was how to obtain a pressure of condensed air of the same density, so as to allow the men to get to the bottom and remove obstacles to the downward progress of the tubbing. This was achieved by constructing an air-tight chamber in three compartments, into which compressed air was pumped in from the surface, until the water was forced out. The man at the bottom, thus enabled to work, filled the kibble with boulders, which were then drawn up into the middle chamber, through a valve-door; the communication was then closed, and a similar door opened in the floor above, and so reached the surface without altering the condition of the air in the chambers. These chambers acted, in reference to the air, like the locks of a canal, forming, in fact, an air-lock.

At first it was considered by scientific authorities at Paris impossible that the men could work in such an atmosphere, but M. Triger tried it first himself at a pressure of 2½ atmospheres, then at 3, and then of 3½ even, and took a regular turn at the work. It was found that the men could stand it very well, the only precaution necessary being that of making the transfer from the one to the other atmosphere gradual. Mr. Triger, indeed, submitted himself to a working pressure of four atmospheres, and, except an uncomfortable sensation in the ears, he found that he could stand it very well, if only he passed through the intermediate stage with sufficient slowness. Steady men of moderate habits, therefore, were easily got to perform the work. In carrying out this ingenious contrivance M. Triger found himself at one time at the very extent of his power, without being able to reap the full advantage, when a very curious accident occurred, which at once suggested the remedy. The water, which is driven back by the compressed air is got rid of by a pipe which is carried up the shaft to the surface, ending in a snore-piece. After the work had gone on for some time, and the depth of the sinking increased, the height of the water column was so great in the pipe that the pressure of the feeder could not drive it up, when one of the men at work in the lower chamber accidentally knocked a hole in the pipe, the compressed air rushed through the hole, and immediately a jet of water was thrown out at the top like the contents of a bottle of soda water. The intermixture of the air which passed through the hole rendered the column of water of so much less weight than the solid water, and hence this remarkable result. In another instance, too much pressure being applied by the air-pump at the surface the water was forced down to the bottom of the escape-pipe, when from the same cause a jet of water shot up to the height of 60 ft. M. Triger, of course, turned this phenomenon to account by a proper admission of air into the pipe, and the water was got rid of with regularity and success. This plan has been found to answer not only in Belgium and Westphalia, but in our colliery districts. Accidents, however, have occurred from having too much air pressure, when the iron chambers have been lifted bodily up. Amongst other modifications of this plan, one carried out was in a shaft sunk by a well-known metallurgical company of Seraing, in Belgium. The chamber was attached to the tubbing; diagonal plates were used to strengthen it, with strong girders of a double T-shape. In the lower part was a portion of the permanent lining forced down by a gradual screw pressure. Various modifications have been carried out in relation to boring. In no district, perhaps, have shafts been sunk so successfully as through beds of alluvium in the Rhine valley, at the western extremity of the Westphalian coal field. A shaft is there sunk 24 feet in diameter to a depth of 72 feet, lined with brick. After going down some depth the diameter was lessened to 15 feet, the lower part being bored with the shaft full of water. For this purpose the shaft was covered with strong beams, and the pumping apparatus set to work. The heavier set of boring-rods were 4½ inches in diameter, the extremities being expanded into arms, forming what is called a "sackbohrer"—a sort of scooping or dredging apparatus. These arms are made to work round and round, and as the sand is thus bagged out the walling is sunk down gradually. Another modification has been used in sinking shafts by M. Chaudron, in the department of the Moselle, at the mines of St. Avold and L'Hopital, 159 metres deep. At this place M. Kind's borers were used, and the shaft is 13 feet diameter in the clear. The object was to place within a series of tubbing, and the borers were made with movable arms, like the ribs of an umbrella, which opened out when at the bottom, and so brought up some of the material. The upper portions of the tubbing was suspended from beams above, and when a firm foundation was reached what is called a moss box is made. This is an opening from 2 to 3 ft. high, behind the usual lining, in which moss is laid very evenly. As soon as this was done the suspenders which supported the upper part were removed, letting it down with its full weight on the moss, which is thus squeezed into all the crevices of the rock, and cement being filled in at the back of the tubbing an impervious joint is made.

Cast-iron labours under the disadvantage of being seriously corroded when the water contains sulphates. Sometimes it may be so injured in the lapse of a few years as no longer to be depended upon to keep back water. In upcast shafts the sulphurous acids and other fumes arising from the furnace will produce a similar effect. With a view to remedy these evils various schemes have been resorted to, such as coatings of varnish or a lining of planks carefully fitted together. This latter expedient is open to the grave objection that in an upcast shaft it would be very dry, and liable to take fire. Another suggestion is to line the interior with thin fire-bricks, just sufficient to protect the iron against these acids; but here, again, it is suggested that if any leakage took place it would be impossible to tell where it was. Taking, good and bad together, cast-iron is, on the whole, the best material for tubbing. These are the different methods of sinking shafts when great difficulties in consequence of the yielding nature of the ground are sought to be overcome. I need hardly say that there are a great number of modifications, some of which I have mentioned. One word of caution, however, is necessary; whatever the nature of the material used, or whatever the character of the tubbing itself, it ought to be carefully watched; and if any leak occurs it should be promptly seen to. Several sad accidents have arisen from the neglect of this caution. I may mention a mine at St. Emilo, about two years ago. The shaft was protected by wooden tubbing, and a number of wedging curves were put in, but, nevertheless, in consequence of a little yielding of the ground, the joints were opened in one length of tubbing. At first the water flowed out slowly, then more freely, then by degrees some of the blocks were forced out of place, and ultimately, before the attention of the chief engineer of the works had been called to the spot, the mischief became so serious that in spite of all they could do the shaft was ruined, and they were only just able to get the men out when the whole collapsed. This catastrophe was clearly the result of a want of sufficient promptness and attention to the first beginning of the mischief.

STANNARIES LAW AMENDMENT.

IMPORTANT COUNTY MEETING.

After private conference by the Committee, a county meeting of persons interested in the amendment of the Stannaries Laws was held on Monday, at Redruth. The meeting was both influentially and numerously attended. Mr. T. S. BOLITHO, ex-High Sheriff, presided; and among others present were Viscount Falmouth, Mr. John St. Aubyn, M.P., and Mr. Pendarves Vivian, M.P.

At the commencement of the proceedings the Secretary (Mr. T. CORNISH) read letters from some gentlemen unavoidably absent.

Sir Massey Lopes merely expressed his readiness to support the measure as it might be agreed on.

Sir William Williams regretted his inability to attend the meeting, but hoped to endorse whatever might be decided on.

Mr. J. H. Murchison, writing from the Junior Carlton Club, said his last letter seemed to have been misunderstood. He was of opinion that what was called the "Cost-book System" should be abolished altogether, as founded mainly on principles which are now impracticable, and unsuited to existing circumstances. He considered that the mining companies of Cornwall and Devon should be subject to the same laws as those which govern similar companies carrying on operations in other parts of the kingdom, and, indeed, joint-stock companies generally. The subject could be discussed generally, and he should think it only just that a meeting should be held in London, as a very large proportion of shareholders reside beyond the two counties named, while hitherto the meetings had been entirely local where the bulk of those likely to compose the creditors reside. If he were to draw attention to the proposed Bill, he would remark on the absence of all provisions as to accounts, while several of the clauses were inconsistent with each other, and some were very objectionable.

Mr. Tapping, of 5, Essex-court, Temple, wrote that he had not seen a memorial to the Prince suggested, praying him to support the proposed Bill. Such a step seemed to him highly advisable, as the Committee could command no end of signatures, and it would give a force to their application to Parliament that could not be withstood.

The Vice-Warden of the Stannaries (forwarding a printed document entitled "Procedure and Process of the Court of the Vice-Warden") wrote—"I enclose a copy, which you may print and annex to your own reprint, but only as they stand. Of course, I do not require their adoption; that I will take upon myself, especially as all the clauses except one, or perhaps two, are matters better understood by Mr. Michell and myself than anyone else. I shall be quite open to observations on any of them. Let me add that next week I hope to be in town, and that it will give me the greatest pleasure personally to communicate with Mr. St. Aubyn, your member, who will, I presume, be in town, and is not a very distant neighbour of mine, especially as he seems to take an active part in your Committee. I intend on my return to devote all the time I can towards furthering your general objects, though I may, perhaps, differ as to the *modus operandi*. A letter of to-day from the department of the Home Office and Parliamentary Counsel informs me that a reference to the Board of Trade will be sooner or later inevitable. I will engage to arrange for a meeting with the Lord Warden and the Prince's attorney as soon as it may become expedient to obtain their avowed support of your Bill."

Mr. R. H. Pike expressed regret that illness prevented his attending the meeting.

Mr. R. W. Childs, of London, prevented from attending by domestic affliction, made several suggestions of verbal and other amendments; and Mr. Christopher Childs, of Liskeard, who had rendered considerable assistance in Committee, was also unable to attend.

The CHAIRMAN (Mr. Bolitho) then reviewed the circumstances connected with the appointment of the Committee on Dec. 10, and its subsequent proceedings, in the course of which he stated that Mr. Michell, the Registrar of the Stannary Court, had offered valuable suggestions in relation to amendments required in the action of the Court. As time pressed, the Committee found it necessary to request the secretary at once to instruct counsel to prepare a Bill, and the secretary was also authorised to go to London and communicate with Mr. Reilly, a parliamentary draftsman. In the meantime several suggestions came in, and some of them were adopted; but several clauses introduced by Mr. Reilly, very stringent in relation to pursers, could not be adopted, and consequently were struck out. Since then the Bill, as thus amended, had been made public. There had been a meeting of the Committee that day, and though there had been strong discussion on two or three points, he might venture to say that it was generally approved, though it would receive several emendations. If this meeting should reappoint the Committee they would be prepared to consider these and any other subjects that might be brought before them. With reference to Mr. Murchison's letter, and two previous letters from that gentleman, he (the Chairman) remarked that, with exception of clause 31, giving labourers' wages priority over other creditors, the present measure did not in any way affect mines which were not worked on the Cost-book Principle. With the one exception referred to, the Bill did not affect mines worked on the joint-stock or limited liability principles. He believed that most gentlemen present approved the Cost-book Principle; and it was to amend that system that the present legislation was proposed. The Cost-book System possessed many advantages over the joint-stock principle, and had all the advantages of the limited liability system, inasmuch as the shareholders had the power of relinquishing shares. But this Bill did not interfere with power to work mines on the joint-stock instead of the Cost-book Principle.

A motion was moved by Mr. BICKFORD, affirming that the meeting approved the proceedings of the Committee, and also generally of the provisions of the Bill now laid before the meeting in draft.

The proposition was seconded by Mr. TEAGUE, and was unanimously agreed to, but not until after the Chairman and Mr. Downing had satisfied Mr. Heard that it was not intended by this Bill to interfere with the existing power in a shareholder to relinquish shares. The Bill only provided that relinquished shares shall be carried into account and recorded in the cost-book, with power to shareholders to appropriate those relinquished shares as they might think proper, either by merging them, or by assigning them to some other person. This mode of dealing with relinquished shares would, he thought, be a great improvement on the present system, by which the purser was bound to merge relinquished shares.

It was next resolved, on motion by Mr. CARTWRIGHT, seconded by Mr. H. GRYLLS, and with thankful acknowledgement of the Committee's past services, that the Committee be requested to continue their services with a view to such alterations in the details of the Bill as may appear desirable, and with power to appoint a sub-committee to confer with members of Parliament in London if it should be found expedient.

The CHAIRMAN, inviting observations on matters of detail, said several communications had been received on the subject of accounts. In the original draft there were two or three clauses affecting pursers; one of them compelling pursers to produce accounts. Those clauses had been struck out; but it had been suggested that they ought to be restored.

Mr. JOHN MICHAEL WILLIAMS said he had heard much regret expressed that those clauses had been struck out. There had already been much depression in mining, and he feared that unless it was carefully provided in the present measure that property in mining would be protected, so that Cornish mining might regain confidence out of the county, that depression would be increased. (Hear.) He thought a clause should be inserted by which pursers should be required to produce a balance-sheet with statement of assets and liabilities at least once in every two months. (Hear, hear.)

Mr. RAWLINGS, of Hayle, hoped the meeting generally approved the very important principle that in all cost-book mines the accounts should be prepared and produced a certain number of times in every year. In open partnerships, such as cost-book mining companies, such production of accounts ought to be made compulsory; and he would suggest that they ought to be so produced at least three times a year.—Mr. Rawlings afterwards adopted, on explanation, of Mr. J. M. William's suggestion of once every three months; and expressed his conviction that the procuring a legislative measure to enforce the production of mine accounts at least four times a year, would of itself amply indemnify the Committee for all their time and labour. He added that this change had been suggested to him long ago by the officers of the Stannary Court. Mr. Rawlings submitted a motion to this effect; which was supported by Mr. REGINALD GRYLLS, who, himself a purser, expressed his conviction that it would be advantageous if no option were allowed, under any circumstances, to stave off meetings beyond appointed intervals; and he thought that two months' intervals were sufficiently long.—Ultimately, it was resolved to recommend the introduction of a clause making it compulsory on pursers to lay before shareholders statements of receipts and expenditure, assets and liabilities, at least once every four months.—A suggestion that such accounts should be produced at all ordinary meetings, whenever held, did not find favour enough to elicit a resolution to that effect.

Mr. REGINALD GRYLLS proposed that Mr. John St. Aubyn, the senior county member, be requested to take charge of the Bill in the House of Commons, and that the other members for the counties included in the Stannaries be requested to assist in passing the measure. He was glad to know that, at a time when they were desirous of seeing the Stannary Laws put on an equitable footing, Cornwall, in both its divisions, was represented by gentlemen than whom none were more capable of rendering assistance in Parliament by their arguments as well as by their votes.——Mr. J. H. PENROSE seconded Mr. Reginald Grylls's proposition, and it was unanimously agreed to.

Mr. J. ST. AUBYN stated that since the last meeting of the Committee he had received assurances from his colleagues both in East and West Cornwall of their readiness to assist in passing this measure; and, therefore, he now, in connection with his colleagues, accepted the task imposed on him. It was one of very great responsibility; he did not know that a task of greater magnitude had ever been imposed on any representative of Cornwall, as affecting the great mining interests of that county, and, therefore, he besought the assistance and indulgence of all.

Mr. PENDARVES VIVIAN said no labour, exertion, or energy should be wanting on his part in rendering assistance in this matter to Mr. S. Aubyn, nor should his presence be ever wanting in Cornwall whenever it might aid in the advancement of its great interests.

Mr. P. P. SMITH stated that, having had an interview with the Vice-Warden, he had that gentleman's authority for stating that he would be most happy in rendering all possible assistance towards passing this Bill. (Hear.)

On a motion by Mr. HAYE, seconded by Mr. R. BOYNS, it was resolved unanimously that the Right Hon. Viscount Falmouth be requested to take charge of the Bill in the House of Lords.

Lord FALMOUTH, willingly accepting his task, said he was happy to think that Cornwall was emerging from its long period of depression, and he considered this a most fitting opportunity for promoting such a measure as that now before them. He believed they must all admit that a great deal of the distress which this county has suffered might have been relieved, or at least mitigated, by some such Act as this, and, therefore, however laborious the task might prove, he should be only too happy in giving his assistance towards passing this Bill, and he hoped he should receive all possible assistance in making the Bill as useful as possible.

On a motion by Capt. WILLIAMS, seconded by Mr. G. MICHELL, it was resolved that the members of Parliament for the boroughs within the Stannaries be requested to assist in passing this Bill.

The CHAIRMAN, after making some observations explanatory of the Bill in its several parts, moved the thanks of the meeting to the Vice-Warden, the Registrar, and other officers of the Stannary Court for the assistance they had given. If the Vice-Warden should succeed in obtaining co-operation from the Duchy Council and the law officers, he need hardly say it would be accomplishing a great work.

Mr. Bolitho's proposition was seconded by Mr. R. R. MICHELL, and unanimously agreed to.

It was afterwards resolved to memorialise in favour of the Bill the Prince of Wales, the Duchy Council, and the Lord Warden, and also to present petitions to both Houses of Parliament.

On the subject of expenditure necessary in passing the Bill through Parliament, rough estimates of which varied from 500l. to 800l., a long discussion resulted in the adoption of a resolution, moved by Mr. H. GRYLLS, and seconded by Mr. MCKEAN, that the expenses be defrayed by subscription, and that mine pursers be requested to bring the matter before their respective companies. It had been suggested in committee that the expense should be met by a rate of 1-8th of a penny in 1l. on the value of all minerals raised within the Stannaries.

The proceedings closed with thanks to the Chairman.—*Western Morning News.*

STANNARIES LAW AMENDMENT.

DRAFT OF BILL PREPARED FOR PRESENTATION TO PARLIAMENT, AS APPROVED BY COUNTY COMMITTEE OF MINE ADVENTURERS.

PRELIMINARY.

1.—This Act may be cited as the Stannaries Act, 1869.

2.—In this Act,—

The term "The Stannaries" means the Stannaries of Devon and Cornwall.

The term "The Vice-Warden" means the Vice-Warden of the Stannaries.

The term "The Court" means the Court of the Vice-Warden.

The term "The Registrar" means the Registrar of the Court.

The term "Company" includes any persons or partnership body working a mine in the Stannaries.

The term "Purser" means the purser for the time being of a company having a purser, and if there is no purser then the secretary for the time being, or if there is no secretary then the principal financial agent for the time being of a company.

The term "Cost-book" includes all books and papers relating to the business of a mine, which are for the time being kept by a purser, or which, according to the custom of the Stannaries or the directions of the company, ought to be kept by him.

3.—This Act extends only to mines within the Stannaries, and subject to the jurisdiction of the Court, or within the cognizance of the Vice-Warden.

4.—Nothing in this Act applies to companies registered under the Companies Act, 1862, except where such companies are expressly mentioned.

PART I.

MEETINGS AND PROCEEDINGS GENERALLY.

5.—Except as otherwise provided by this Act, or by the conditions, rules, or regulations of any company, a resolution passed at a meeting of a company by the votes of a majority in value of such of the shareholders as are present in person or represented by proxy at the meeting, shall be deemed the resolution of the meeting; but nothing in this clause shall authorise any ordinary meeting to transact any business which an ordinary meeting could not transact at the time of the passing of this Act, except as is hereinafter provided in clauses 10, 11, and 12.

6.—Where anything to be done by a company is by this Act required to be done at a meeting with special notice, it shall not be valid if done otherwise than at a meeting, notice whereof is served on the several shareholders ten clear days at least before the day of the meeting, specifying the place, day, and hour of meeting, and the business to be transacted thereat, or so much thereof as is required to be done with special notice.

7.—A resolution passed by a company shall be deemed a special resolution within this Act when it has been passed at a meeting with special notice, and has been confirmed at a subsequent meeting with special notice, the last mentioned meeting being held not less than 14 days, and not more than one month, after the meeting at which the resolution was first passed.

8.—A company may by special resolution from time to time alter the conditions, rules, and regulations for the time being by custom or otherwise governing the company, and make new or additional conditions, rules, or regulations, in that behalf, and any conditions, rules, or regulation, so made by special resolution shall be of the like validity and effect as if they had been entered in the cost-book on the original formation of the company, subject to alteration by subsequent special resolution; but nothing in this act shall authorise a company to make conditions, rules, or regulations, inconsistent with the provisions of this Act.

9.—A notice to be served by a company for any purpose of this Act on a shareholder shall be served personally, or shall be served by prepaid letter sent by post addressed to him at his address entered in the cost-book, in which case the notice shall be taken as served at the time when the letter containing it would be delivered in the ordinary course of the post; and in proving such service it shall be sufficient to prove that the letter was properly addressed and prepaid, and was put into the post-office, and the time when it was put in, and the time requisite for its delivery in the ordinary course of the post.

As regards a company existing at the passing of this Act, the address of a shareholder as known to the purser at the passing of this Act shall be and remain entered in the cost-book as his address, unless and until he gives notice in writing to the contrary; and as regards any company no address shall be recognised except an address within the United Kingdom.

ACCOUNTS, ETC.

10.—Each purser shall once at least in every four months truly enter in the cost-book of the company accounts showing the actual financial position of the company at the time of entry, including accounts of the assets, credit, and liabilities, with cash accounts, and accurate lists of all the shareholders for the time being in the company, with their respective addresses, corrected from time to time as occasion requires, and all other accounts, documents, and things which the purser is for the time being required to enter therein by the custom of the Stannaries or by the directions of the company.

CALLS.

11.—At any meeting of a company the accounts of the company may be audited, and a call may be made.

12.—A call may be made by a company for the purpose of defraying the whole or any portion of the estimated expenses to be incurred at any time within three months after the date of the meeting at which the call is made.

13.—If a call payable in respect of a share is not paid within one month from the day appointed for payment thereof, the holder for the time being of such share shall be liable to pay interest on the amount of the call at the rate of 5*l.* per centum per annum, from the expiration of that month to the time of actual payment.

TRANSFER OF SHARES.

14.—A company shall not be bound to recognise a transfer of a share until all calls made in respect of such share with interest and expenses have been paid.

15.—A company shall not be bound to recognise the transfer of a fractional part of a share.

FORFEITURE OF SHARES.

16.—If a shareholder fails to pay a call on the day appointed for payment thereof, the company may at any time thereafter, during such time as the call remains unpaid, serve a notice on him requiring him to pay such call, together with interest and any expenses that may have accrued by reason of such non-payment, and stating to the effect that in the event of non-payment in accordance with the notice, the share in respect of which such call was made will be liable to be forfeited.

17.—If the requisitions of any such notice as aforesaid are not complied with, any share in respect of which such notice had been given may at any time hereafter, before payment of all calls, interest, and expenses due in respect thereof has been made, be forfeited by a resolution of the company to that effect, passed at a meeting, with special notice.

18.—Any share so forfeited shall be carried to an account to be called "The Account of Forfeited Shares," and shall be deemed to be the property of the company, and shall be sold by public auction, as the company direct, and if there are more shares than one, then separately or together, and any shareholder may purchase any such share.

19.—Where a shareholder fails to pay a call in respect of more shares than one, the company shall not sell more of his shares than shall be sufficient (as nearly as can be ascertained at the time of sale) to pay all calls, interests, and

expenses payable on or in respect of his shares at the time of forfeiture, and expenses attending the forfeiture and sale, and if the proceeds of any such sale more than sufficient to pay all calls, interest, and expenses, as aforesaid, the surplus shall on demand be paid to the person whose shares are forfeited.

—If before any share so forfeited is sold by the company, all calls, interest, expenses payable to the company on or in respect of the same are paid, then share shall revert to the person to whom it belonged before the forfeiture, shall belong to him as if the calls thereon had been originally duly paid.

—A statutory declaration in writing by the purser of a company that the in respect of a share was made, and notice thereof given, and that default the payment of the call was made, and that the forfeiture of the share was made by resolution of the company to that effect, shall be sufficient evidence of the facts therein stated as against all persons entitled to such share, and such declaration and the receipt of the purser for the price of such share shall constitute a good title to such share, and the purchase shall be entered in the cost-book as a shareholder in respect of the share, and thereupon he shall be deemed the holder of such share discharged from all calls due prior to such purchase, and he shall not be bound to see to the application of the purchase-money, nor shall his title to the share be affected by any irregularity in the proceedings in reference to such sale.

—Any shareholder who share has been forfeited shall nevertheless be liable to pay all calls, interest, and expenses payable on or in respect of the same at the time of forfeiture.

RELINQUISHMENT OF SHARES.

—Where a share in a company is relinquished it shall be carried to an account to be called "The Account of Relinquished Shares," and shall be deemed to be the property of the company, and may be disposed of as the company direct, according to the custom of the Stannaries or otherwise, and any shareholder may purchase any such share if sold, but if any such share is not sold, otherwise disposed of by the company within six months from the date of relinquishment it shall cease to exist, in accordance with the custom of the Stannaries.

—A company shall not be bound to recognise the relinquishment of a fractional part of a share.

—A statutory declaration in writing by the purser of a company that a share has been relinquished shall be sufficient evidence of the facts therein stated as against all persons interested in the share, and that declaration and the receipt of the purser to a purchaser of the share for the price thereof shall constitute a good title thereto, and the purchaser shall be entered in the cost-book as a shareholder in respect of the share, and thereupon he shall be deemed the holder thereof, discharged from all unpaid calls, interest, and expenses due to the company in respect thereof accrued before his purchase, and he shall not be bound to see to the application of the purchase-money, nor shall his title to the share be affected by any irregularity in the proceedings in reference to such sale.

ENFORCEMENT OF CLAIMS.

—All money payable by a shareholder to a company in pursuance of the customary or other conditions and regulations of the company, becoming due after the passing of this Act, shall be deemed to be a debt due from the shareholder to the company, and shall be recoverable on behalf of the company by action, suit, or other fit proceedings by the person who is purser at the time when proceedings for recovery thereof are instituted, and in case of a change of purser pending the proceedings, the name of the purser for the time being may, by leave of the Court in which the proceedings are pending, or of a judge, or a proper officer thereof, be substituted for that of a person ceasing to be purser by death, resignation, or otherwise.

SALE OF MINE.

—Without prejudice to the provisions of the setts under which a company held a mine, the company may by resolution passed at a meeting, with special notice, by the votes (given in person or by proxy), of three-fourths or upwards in value of all the shareholders in the company, sell, as a going concern, the mine and the setts thereof, and the machinery and other effects of the company on the mine; provided that every such sale shall be by public auction, and public notice thereof shall be previously given by advertisement inserted, once at least, in each of four successive weeks in a newspaper published in London or Middlesex, and once at least in each of the same four weeks in each of two or more newspapers published, and having a large circulation, in the county in which the mine is situated, and that nothing in this section shall authorise such a sale in the case of a mine in which a profit has been made within the 12 months next preceding the day of sale, as appearing from the accounts of the mine.

WINDING-UP.

—On a company being wound-up in the Court of the Vice-Warden, or any other Court, a former shareholder shall not be liable to contribute to the assets of the company if he has ceased to be a shareholder for a period of two years or upwards before the mine has ceased to carry on business, or before the commencement of the winding-up.

—On a company formed for or engaged in working a mine (including a company registered under the Companies Act, 1862) being wound-up in the Court of the Vice-Warden, or any other Court, or otherwise, the commencement of the winding-up having been not earlier than *two months* after the passing of this Act; then, and in every such case, the amount (if any) due at the commencement of the winding-up to agents, clerks, miners, labourers, and others employed, wholly or in part in or about the mine, in respect of their salaries and wages or other earnings in relation to the mine, not exceeding *three months'* salary, wages, or earnings, to each such person, shall be paid in priority to all other debts of the company.

PART II.

PROCEDURE AND PROCESS OF THE COURT OF THE VICE-WARDEN.

—Whereas, since the passing of the Act 18 Vic., c. 32, for amending and extending the jurisdiction of the Court of the Vice-Warden, and of the Companies Act, 1862, the experience of the Court has suggested the expediency of some amendment of the provisions of those Acts, so far as they relate to the Stannaries and the jurisdiction thereof, be it enacted:—

That all affidavits, affirmations, and declarations shall be available in suits, causes, and matters in the Court of the Vice-Warden, although not sworn, made, and taken by or before a commissioner of that said Court; provided the same shall have been sworn, made, or taken by or before any commissioner authorised to administer oaths in the superior courts of equity or of common law in England or Ireland, or in the Isle of Man or the Channel Islands, or by the officers exercising like powers to administer oaths in Scotland, or by any of the Courts, judges, or other persons having like authority in the dominions of the Crown beyond seas or in foreign parts, specified or described in the Act 15 and 16 Vic., c. 86, sec. 22; and the Act 16 and 17 Vic., c. 78. And the Vice-Warden or Registrar of his Court shall, on the production before him of such affidavits, affirmations, or declarations, purporting to be duly and regularly sworn, made, and taken by any of the Courts or persons hereinbefore referred to, be presumed to have been so sworn, made, and taken, unless the contrary be proved to his satisfaction. And in case of wilful and corrupt false swearing, affirming, or declaring in such document so produced, or of the production or use by any party of such document, knowing the same to be a forged or spurious one, the offender shall be liable to all the penalties, punishments, and consequences specified in sections 23 and 24 of the Act 15 and 16 Vic., c. 86. Provided also that all lawful fees due and demandable upon swearing, making, or taking such affidavits, affirmations, or declarations, by or before any of the Courts or persons above referred to, shall be paid, or tendered, to such Court or person by the party applying for such document.

—Whenever a decree or order of the Court of the Vice-Warden for payment of money, or production or delivery up of any books, papers, deeds, or accounts, or the delivery up of property, real or personal, shall have been made in a suit or matter whereof the said Court has cognizance, no formal demand shall be necessary, but the person or party who shall have been so decreed or ordered to pay such money, or produce or deliver up such documents or property, on being duly served with such decree or order, shall be bound to obey the same, and process shall thereupon issue to enforce performance, without further special application to the Vice-Warden.

—In enforcing execution of any judgment, decree, or order of the Court of the Vice-Warden by writ sent to the Registrar of any County Court under sec. 9 or 10 of Act 18 Vic., c. 32, the person or party entitled to recover any monies awarded to him by such judgment, decree, or order, may issue such process to the County Court, although the sum sought to be recovered may exceed the sum of 50*l.*, provided the sum do not exceed 300*l.*, including the costs of applying to the Court for leave to issue such execution where such leave shall be necessary by the rules of the Court. And such process shall hereafter be available to any party entitled to levy such money, not exceeding the said sum of 300*l.*, by a like writ of execution sent to the Registrar of any County Court within the Stannaries, as well as beyond the Stannaries; subject, however, to the payment of the lawful fees for execution in such County Court, and subject in other respects to the provisions of sections 9 and 10 of the Act last above mentioned, except that the Judge of a County Court within the Stannaries may remit any claim of interest arising on the execution of such writ, for determination of the Court of the Vice-Warden.

—If any person residing or being within the jurisdiction of the Stannaries, shall be in contempt for disobedience of any order of the Court of Vice-Warden other than the payment of money, and be thereupon attached by the bailiffs of the Court, or by a messenger or messengers of the Court especially named or appointed by the Court for execution of the writ of attachment issued by the Court, such bailiffs or messengers shall forthwith take into their custody the person so attached, and bring him with all convenient speed to Truro, there to be examined by or before the Vice-Warden, if he shall then be sitting at Truro, or before the Registrar of the Court, touching the matter of his alleged contempt; and upon such examination, the Vice-Warden or Registrar shall, if the offender shall have sufficiently cleared himself of the contempt, discharge him out of custody; or if he shall not have so cleared himself, shall commit him to the common goal at Bodmin, or, in case of contempt within the Stannaries of Devon, to the Borough goal at Plymouth, there to remain until he shall have submitted to the order of the Court, or be otherwise discharged in due course of law; and such writ attachment, and any commitment thereon, shall issue in the name of the Lord Warden of the Stannaries, with the seal of the Court attached.

—Whereas the service of process on the common law side of the Court of the Vice-Warden, in any part of England, without the special order of the Vice-Warden, has been found inconvenient, and in some cases liable to abuse, be it enacted that no such service of process out of the limits of the Stannaries, in suits or plaints on the common law side of the Court, shall hereafter be effected without the special order of the Vice-Warden, made on a statement of the nature and object of such or plaint; except in the case of actions of ejectment, brought under the authority of sec. 15 of the Act 18 Vic., c. 32.

—In all cases of appeals against any judgment, decree, or order of the Court of the Vice-Warden, besides the bond to the Registrar of the Court required by the Act 18 Vic., cap. 32, sec. 26, a deposit of 20*l.* shall be made in the hands of the Registrar of the Court, to be paid to the opposite party when the judgment, decree, or order is not reversed or varied in any material point; unless the Court shall otherwise direct; and if the appeal against any decree or order be prosecuted in the name, or on the behalf of, any registered company with limited liability, the Registrar of the Court may require that a sufficient surety be joined, as co-obligor, in the bond which the appellant is bound to give in such case, who shall be personally liable to pay the taxed costs of the appeal to the extent of 50*l.*, if the judgment, decree, or order be not reversed or varied in any material point; and the appellant shall also deposit in the hands of the Registrar the sum of 20*l.*, payable as hereinabove directed in the case of ordinary appeals.

—Where an order is made for the winding-up a mining company in the Court of the Vice-Warden, whether the same be a registered or an unregistered company, and no official liquidator is appointed, the Registrar of the Court shall have authority, with the sanction of the Vice-Warden, to perform all the ordinary duties of an official liquidator, and to exercise all the powers assigned by the Companies Act, 1862, to such liquidator, so far as such duties or powers are not incompatible with his official duties as Registrar of the Court.

Provided always that the Registrar shall not, in such case, be called upon to give any such security as may be required of an official liquidator under sec. 92 of the last-mentioned Act, nor be entitled to any remuneration for the performance of the said duties other than the salary now received by, or that may hereafter be assigned to him, in his official character of Registrar; nor shall it be necessary for him to use the name or style of official liquidator, nor any other style than that of Registrar of the Court, unless it shall become necessary for him to take out letters of administration to any deceased contributory; and in proving a debt due from any contributory who shall have become a bankrupt within the intent and meaning of sec. 87 of the Companies Act, 1862, a certificate of the debt signed by the Registrar, with the seal of the Court attached, shall be accepted in the Court of Bankruptcy as sufficient proof of such debt as against the estate of the bankrupt, without requiring the oath or affidavit of the Registrar.

Provided, also, that the Registrar in the performance of such duties and exercise of such powers shall not be liable to any penalty prescribed by the said Companies Act, 1862, and imposed on official liquidators as such, or become personally liable in respect of any act done or proceeding taken by him, by the order or authority, or with the sanction, of the Vice-Warden acting in his judicial character.

—In cases where several mining companies are in course of liquidation by or under superintendence of the Court of the Vice-Warden, if it shall appear to the Vice-Warden that a person who is a contributory of one of the said companies is also a creditor claiming a debt against one of the other companies, the Vice-Warden may, in his discretion, and after due enquiry into the facts, direct that the said debt, when allowed, shall be attached, and payment thereof to the creditor suspended for a time certain, as a security for payment of all or any calls that are, or may in course of liquidation become, due from him to the company of which he is a contributory, and the amount thereof shall be applicable and applied to such payment in due course; provided that no such order of attachment shall prejudice any claim which the company so indebted to him as creditor may have against him by way of set-off, counterclaim, or otherwise; or any lawful claim of lien or specific charge on the said debt in favour of any third person.

—A transfer of shares made for the purpose of getting rid of the further liability of a shareholder, as such, for a nominal or no consideration; or to a person without any apparent pecuniary ability to pay the reasonable expenses of working a mine; or to a person in the menial or domestic service of the transferror, shall be presumed to be a fraudulent transfer, and need not be recognised by the company, or by the Court on the winding-up of the company, whether the company be a registered or unregistered company.

—The jurisdiction of the Court to grant injunctions restraining sales of machinery and other effects on mines, is hereby extended so as to authorise the granting of injunctions restraining sales of setts where equity so requires, and the jurisdiction conferred by this section may be exercised in creditors' suits, or on the application of a shareholder in a company.

—It shall be competent for the Registrar of the Court to issue injunction orders on customary creditors' suits pending in the Court, and to forbid the sale of machinery or other effects on or belonging to the mine on the usual allegation of urgency; or to issue such orders in other cases of like urgency, or imminent waste or damage to property; and in such cases the party or parties so injoined may appear and show cause before the Registrar, and apply to him to suspend or dissolve the order; but such application to the Registrar shall not be exclusive of the exisiting power of the Vice-Warden to issue such orders, though he may not then be setting within the jurisdiction of the Stannaries, nor prevent him from the re-considering the order of the Registrar on the motion or complaint of the parties interested in it. [This stands as drawn by the Vice-Warden, but if 39 stands, and the committee are strong for it, this clause should be altered to meet it, as in clause 37 of the draft.]

—The provision of sect. 83 of the Companies Act, 1862, contained in second paragraph thereof, shall be amended and read as follows:—That the Vice-Warden of the Stannaries may direct that petitions to wind-up a company be heard by him at such time or place as he may think fit within the jurisdiction of the Stannaries, or within or near to the place where the registered or other chief office of the company is situate; or, if such office be distant 150 miles or more from Truro (measured by the public railways), then in London or Westminster; or, with the consent of the party or parties petitioning, and of the company, represented by its secretary, purser, or other proper officer, the hearing may be in any part of England; and all orders made by the Vice-Warden on such hearing, in any of the above cases, shall be as valid and effectual as if they had been made at Truro.

—Let the sections of the Act 7 and 8 Vic. (sec. 22 and 23) and the 28th sec. of the Act 18 Vic., c. 32, be repealed; and in lieu thereof be it enacted that, if in consequence of illness or accident, or other disability, the Vice-Warden shall not attend at Truro on the day and time appointed for his sittings there, the registrar shall have power to open the Court and adjourn the sittings to some other day, on which adjournment day all persons summoned or bound to attend the sittings shall be in attendance, as if the Vice-Warden himself had adjourned them; and if, by reason of such illness, accident, or other disability, or for any other cause deemed by the Lord Warden to be a reasonable cause, the Vice-Warden shall desire to appoint a deputy for a time certain, not exceeding ——, he may, with the approval of the Lord Warden, appoint such deputy, being a barrister of five years standing and not less, with all the powers and judicial functions of the Vice-Warden himself; and if the Vice-Warden shall, by reason of such illness, accident, or disability, be unable, or shall neglect, to make such appointment, it shall be competent for H.R.H. the Duke of Cornwall, or for the King or Queen Regnant, as the case may be, to nominate such temporary deputy, with the qualification, powers, and functions aforesaid, with such directions touching the remuneration of such deputy as may be thought fit.

—Whereas by the Act 6 and 7 Vic., c. 106, sec. 17, the Court of the Vice-Warden is, for the purpose of the entry of pleadings, orders, proclamations, and other matters touching practice, process, or execution, to be at all times open except on Sunday, Christmas-day, Good Friday, and days of public fast or thanksgiving; and no other days or times are specified wherein the Court or its offices may be lawfully closed; nor any period of vacation for the Court or its officers and clerks provided, Be it enacted that the Court and offices may hereafter be closed on Christmas-day and the six following days, on Good Friday and the six following days, and that the space of six consecutive weeks, beginning on the 1st day of September in every year, shall be deemed to be the vacation of the said Court, during which the attendance of the officers of the Court will be dispensed with; so nevertheless that during the continuance of those days and times, and the above vacation, provision shall be made for the receipt and payment, or payments, of money by or to the proper officer of the Court, whereof due notice shall be from time to time given. Provided also that during such times and vacation applications may be made for injunction orders either to the Vice-Warden or to the Registrar, in any part of England, whether within or beyond the ordinary jurisdiction of the Stannaries.

—The powers contained in the Act 18 Vic., c. 32, sections 23 and 26, for making general rules and orders of the Court of the Vice-Warden touching the procedure, practice, pleading, court fees, taxation of costs, and forms, on the equity and common law side of the said Court, and other business of the said Court, and also touching the regulation of the practice, fees, and costs of appeals pending before the Lord-Warden of the Stannaries, whether heard by and before himself, or remitted by him for the determination of the Judicial Committee of the Privy Council, or to the Court of Appeal in Chancery, shall be deemed and taken to extend and apply to this Act, and to the several provisions so contained therein.

PART III.

SAVINGS.

—Nothing in this Act shall take away or abridge any right or remedy of any creditor of a company existing at the passing of this Act, in respect of a debt or liability accrued or incurred before the expiration of two months from the passing of this Act.

Subject and without prejudice to the operation of the other provisions of this Act, this Act shall not be deemed to abolish or restrict any customary or other jurisdiction, power, right, remedy, or privilege, legal or equitable, exercised or enjoyed by the Court, or by creditors, shareholders, or others under the law or practice in force in or in relation to the Stannaries, at the passing of this Act, and subject and without prejudice, as aforesaid, the jurisdiction, powers, rights and remedies given by this Act, shall be cumulative.

FOREIGN MINING AND METALLURGY.

The development of the colliery workings of France has not at all slackened in 1868, and it may be presumed, judging from the particulars collected up to the present time, that the production of the collieries had increased, during the period in question, to at least 128,041,000 metric quintals (12,600,000 tons), of the value of 6,125,600*l.* The get for the previous year was estimated at 123,600,000 quintals, showing the increase to have exceeded 4,000,000 quintals. The consumption has progressed almost as rapidly as the production, and there is every reason to believe that it increased from 199,000,000 quintals in 1867 to 203,000,000 quintals in 1868. If these results (says *La Houille*) be compared with those for 1859, for which the production and the consumption were respectively but 76,810,000 quintals and 132,621,000 quintals, it will be seen that in the 10 years the production has increased by about seven-tenths, and the consumption by more than half. It is not uninteresting to remark that the selling price of the metric quintal has remained almost stationary, being 1 fr. 21 c. in 1859, and 1 fr. 19 c. in 1868. In consequence of statutory applications, there has been granted during the last-named year six coal mine concessions, upwards of 6200 acres in extent (of which two are in the Upper Alps, two in Gard, and two in Savoy). There are now 616 colliery concessions in all, covering nearly 650,000 acres. On Jan. 1, 1869, there were 39 other applications for concessions under consideration.

Stagnation must be said to be the continued characteristic of the Belgian coal trade; prices have not experienced much change, but the demand has sensibly declined during the last few days. This state of things is regarded as the commencement of a period of calm, which usually presents itself at this period of the year, but which is not of very long duration. In the Liége basin the demand for coke is tolerably active; there is a regular current of affairs, which is developed in a remarkable manner. In the Charleroi basin the demand for commercial coal has experienced a check; but, on the other hand, the sale of coal for industrial purposes is maintained, and even displays a serious tendency to develope itself. The Couchant de Mons, notwithstanding very restricted deliveries, maintains its extraction at the same level, and the result is the formation of an increasing stock. Prices are maintained on favourable conditions. The Belgian iron markets remain firm, and several works have decided this week to make a slight further advance in some descriptions of iron; plates follow also the upward movement. One of the leading industrials of Belgium has returned from St. Petersburg with an order for ten locomotives for a Russian railway; this is the only share, however, reserved to Belgium in a contract for 70 locomotives, which has been let for the railway in question.

The working of the Prussian blast-furnaces is at present being carried on upon more regular conditions than during the past year. Pig is sold almost as soon as it leaves the furnace, and in no warehouse are there any considerable stocks. There is no talk at present as to extinguishing blast-furnaces; on the contrary, it is expected that some of those which have been a long time out of use will be re-lighted. Although the price of merchants' iron displays a continually upward tendency that of pig remains the same, a circumstance arising from the competition of Luxembourg and England. In the Siegen district, in which minerals yielding pig of superior quality are obtained, the production of steely pig has very greatly developed itself. Nevertheless, the result is not altogether favourable, the principal reason being the high cost of transport; this obstacle will, perhaps, disappear during the current year, as the Prussian Government is expected to make serious efforts to secure a satisfactory solution of the question of tariffs. Annexed is a statement showing the dividends paid for 1867-8 by some of the industrial companies of Prussia:—Company for Working Forges at Rothe-Erde, near Aix-la-Chapelle, 9 per cent.; Iron Industry Company at Styrum, near Oberhausen, 8 per cent.; Company for the Working of Mines and Forges at Arenberg, 3 per cent.; Company for the Working of Mines and Forges at Hochstahl, 6 per cent.; Company for the Production of Cast-steel, and for the Working of Mines at Bochum, 8 per cent.; Company for the Working of Mines and Blast-Furnaces at Bonn, 3 per cent.; Concordia Company, for the Working of Mines, Blast-Furnaces and Forges at Eschweiler, 2 per cent.; George and Mary Company, for the Working of Mines, Blast-Furnaces, and Forges at Hanover, 9 per cent.; Company for the Working of Mines, Blast-Furnaces, and Forges at Hoerde, 9 per cent.; Company for the Working of Mines, Blast-Furnaces, and Forges at Neu-Oegl, 5 per cent.; New Scotland Company, for the Working of Mines, Blast-Furnaces, and Forges at Horst, near Steele, 4 per cent.; and Vulcan Company, for the working of Mines, Blast-Furnaces, and Forges in Silesia, 2½ per cent. The aspect of the Prussian markets for iron in bars, as well as that for rails, remains good. According to statistics recently published by the Central Bureau of the Zollverein, the commerce of the ports of the Baltic and North Seas was very active in 1867, and showed an essential improvement upon 1866. Thus, the imports of pig into the Baltic ports amounted in 1867 to 31,288 tons, or 22 per cent. more than in 1866; of the imports of 1867, 28,919 tons came from Great Britain. The imports of iron in bars were 4146 tons, or 200 per cent. more than in the year 1866; of the imports of 1867, 2436 tons came from Great Britain, and 1657 tons from Sweden and Norway. The imports of rails in 1867 were 5237 tons, or 63 per cent. less than in 1866; of the rails imported in 1867, Great Britain supplied 5174 tons. The imports of heavy goods of iron and steel amounted in 1867 to 3727 tons, or 56 per cent. more than in 1866; in these imports Great Britain figured for 297 tons, and Belgium for 578 tons.

A kind of official bulletin has been issued by the French Forge-masters' Committee as to the state of siderurgical industry in France. The committee state that in the Loire group prices are firm and regular, and there has, indeed, been an advance of 16s. per ton at Lyons, the price of first-class iron at the large merchants is 8*l.* per ton, the scale between classes is 8s. per ton. On the markets of Languedoc the regularity of quotations is not so great as in the Loire group; there is, however, work on hand for the winter, and even beyond. In the group of the Gard much the same state of things prevails. In the Franche-Comté group the price of pig is not so high; it remains at 4*l.* 16s. to 5*l.* 8s. per ton. Quotations of iron have experienced an advance in this group of 8s. per ton, having been carried to 14*l.* 8s. per ton. Stocks have almost entirely disappeared, and better times are anticipated. In the centre group there has been an advance of 16s. per ton on the Tours market as compared with last summer; the scale between classes has been well maintained. The foundries have orders on hand for large pipes, but not for small ones; upon the whole, the tendency of affairs is towards improvement. In the Moselle group pig has risen from 8s. to 16s. per ton, there are four months' orders on hand, and prospects for the future are considered good. In the basin of the Escaut prices have advanced 8s. to 12s. per ton, and remain firm. The scale between classes is well maintained, and there is employment on hand for all the works for two months at least. In the Paris basin there is quite an accumulation of orders, and work is on hand for more than six months. Stocks of pig are entirely exhausted. In the north of the Moselle there is a good current of affairs, and work is assured for six months at least. There would be a notable advance if the old contracts on hand were completed and carried out. In the Ardennes the forgemasters have a tolerable amount of work on hand, but some of the local industries, such as nail-making, are rather inactive. The price of merchants' iron has risen 7*l.* 12s. at the works, with a scale of 8s. per class. A forgemaster of the north of the Moselle states that his production of coke-made pig is disposed of for half-a-year to a year in advance; it is now quoted at 2*l.* 12s. 10d. per ton. Three blast-furnaces, in consequence of accidents, have been put out of blast in this group. In the Champagne district the situation is satisfactory. The difference between classes has been well maintained at 8s. per ton; there has also been an advance of 4s. per ton in first-class, and 4s. per ton in mixed classes. The price of first-class charcoal-made iron is 9*l.* per ton; there is still rather a considerable stock on hand. Charcoal-made pig is at 4*l.* 4s. per ton. In the south of the Moselle there are orders for some months in advance, and they continue to arrive; as compared with the summer, an advance of 12s. per ton has taken place in prices. The Northern of France Railway Company has ordered 14,000 tons of iron rails from the house of Wendel, at 7*l.* 16s. per ton, delivered at Laon: and 6000 tons of iron rails, from the Denain and Anzin Company, at 7*l.* 16s. 10d. per ton at the works. The same company recently put in adjudication 6000 tons of Bessemer Vignoles rails; the Terre-Noire Company obtained the contract at 13*l.* 14s. 3d. per ton at La Chapelle. The Imphy St. Seurin Company tendered at 13*l.* 16s. 9d. per ton, and MM. Petin, Gaudet, and Co. at 14*l.* per ton. The Terre Noire Company has also obtained an order for 2000 tons of Bessemer steel rails at 13*l.* 11s. 10d. per ton, delivered at Gray. The Imphy St. Seurin Company tendered unsuccessfully at 13*l.* 4s. per ton.

The French tin markets have presented little change; the tone of business has been feeble, but prices have not been much lower than last week. The German markets have been firm, and have even displayed an upward tendency as regards zinc and lead; with respect to copper and tin, it may be observed that they present little change. The Dutch tin markets maintain much the same aspects as of late. Holders refuse to do business in Banca below 67½ fls., a price indicated in recent bulletins, but on these terms purchasers do not present themselves. At Havre, Chilian copper in bars has made 75*l.* per ton; refined ditto in ingots, 78*l.* to 80*l.* per ton; and Peruvian (pure standard), 75*l.* per ton.

AUSTRALIAN MINES.

YUDANAMUTANA COPPER.—The directors have advices from their superintendent, dated Adelaide, Jan. 6. He states—"I returned from my visit to Blinman on the 23d ult. Capt. Terrell's report was prepared during my stay there. I have not, therefore, furnished a visiting report, as it would be simply a reflex of his, now in your hands. I can confirm, with confidence, every item contained in it." Capt. Terrell reports, under date Dec. 28—"Blinman Mine: No. 1 winze is down 35 fms. The lode at present is about 2 ft. wide, and will yield about 10 tons of ore per fathom. No. 2 winze is down 32 fms. I put the men to drive on a branch south, and cut a contra branch, 1 ft. wide, of good ore; I shall for the present sink on this branch; the underlie is about 18 in. to the fathom, and will yield about 4 tons of ore per fathom. No. 3 winze is down 17 fms.; I consider this one of the most important workings of the mine at present, as the ore is dipping north into whole ground, which has never been opened. The lode will produce from 12 to 14 tons of ore per fm. No. 3 or main shaft is down 30 fms. I let a contract to sink 10 fms., and after sinking about 3 ft. we cut a good branch of ore, about 1 ft. wide. I put a pare of men to drive on a branch of ore south of No. 1 winze, and am pleased to say the branch improves; it is, in fact, a fine lode, 2 ft. wide, solid ore, and will yield about 10 tons of ore per fathom. The stopes above the 10, north and south of the Chimney Bunch, are much the same as they have been for many months past. I have sent a sample of our third-class ore; we have about 300 tons on hand, which is in addition to the third-class ore returned by Capt. Anthony, and remaining on hand since he left. My monthly returns being made up to the last day of the month (Thursday next), cannot be included in this report, as the mail leaving here arrives in Adelaide four hours after the departure of the English mail. The fire-brick department continues to work well, and the saving to the company is consequently very great, the cost of English bricks delivered on the mine having been 33*l.* per thousand, while the Blinman bricks cost only 10*l.* per thousand. I am glad to say more teams are arriving on the mine, and the diggers returning to steady employment. After the holidays our returns will be good. In conclusion, the mine is looking exceedingly rich, and every prospect of large returns of copper being made during the next year. All other matters connected with the mine are going on satisfactorily."

WORTHING.—Jan. 5: We have not done much towards sinking the engine-shaft during the month, the most of the time having been taken up repairing the breakage and timbering the shaft, which I am thankful to say is completed, and the men going on sinking, so that in my next report I hope to be able to give the measurement. In the 83 north we have met with another heave, which has improved the lode, and eased the ground for driving; I cannot give you the size of the lode, having only one wall, but it appears to be a large powerful lode, yielding about 3 tons of ore to the fathom in driving; ground driven during the month, 3 fms. 4 ft. 7 in.; present price for driving, 5*l.* per fathom. The rise in the back of the 83 continues good, but hard for working; ground risen during the month, 1 fm. 2 ft.; present price for rising, 16*l.* 10s. You will please bear in mind this is only part of a month's work, owing to the hindrance caused by the breaking of the balance-bob. The winze in the bottom of the 53 fm. level continues rather hard, but the lode continues good; ground sunk during the month, 2 fms. 4 ft. 1 in.; present price for sinking, 17*l.* per fm. The stopes are about as usual, except what is worked out. Ore raised and dressed during the month, 130 tons. Copper shipped, 18¾ tons. Ore on hand, 76 tons of 9 per cent. Regulus on hand, 25 tons of 50 per cent. Number of hands employed, 120.

PORT PHILLIP AND COLONIAL GOLD.—Mr. Bland (Clunes, Dec. 31) writes—"The quantity of quartz crushed during the four weeks ending Dec. 9 was 5085 tons. The pyrites treated was 76¼ tons. Total gold obtained, 2214 ozs. 14 dwts.; yield per ton, 8 dwts. 17 grs. Receipts, 8244*l.* 5s.; payments (including 1763*l.* 8s. paid on account of timber and firewood contracts), 6131*l.* 12s. 11d.; profit, 2112*l.* 12s. 1d., added to which was last month's balance of 2175*l.* 2s. 10d., thereby making an available balance of 4269*l.* 14s. 11d. The amount divided between the two companies was 2000*l.*, the Port Phillip Company's proportion of which amounts to 1300*l.* The balance of 2269*l.* 14s. 11d. was carried forward to next month's account. The return for the two weeks ending Dec. 24 was—Quartz crushed, 2927 tons; total gold obtained, 1220 ozs. 14 dwts.; yield per ton from quartz alone, 8 dwts. 8 grs.; remittance, 1300*l.*"

AUSTRALIAN UNITED GOLD.—Mr. Kitto (Victoria, Jan. 4) writes—"Duke of Cornwall Mine: Sharp's shaft is now 122 ft. deep, and when 10 ft. deeper I shall cross-cut for Cattle's lode (at the same level as in Daukes' shaft) in the first instance, and eventually for Ferron's and Little's. There has been a considerable increase of water in the shaft during the past fortnight, and in consequence of there being no communication with Dauke's shaft, in which the temporary pumps are fixed, we cannot drain it; this shaft cannot be sunk below the present lift until the main pumps are fixed. Dauke's shaft is now 40 feet deep; ground hard, and water increasing. The end of the cross-cut towards Cattle's lode (at the 130 ft. level) is 145 ft. from the shaft; if the ground gets no harder we shall cut the lode before the February mail leaves.—Old Engine-shaft: The eastern cross-cut, towards Little's lode, is now 180 ft. from the shaft, and had it not been that the holidays are so numerous here at Christmas we

should have cut the lode before this. Judging from the softness and mineralised character of the country, we are not far off it. Pending the proper opening of the mine, I have employed one man to drive on Cattle's lode, which you will remember I informed you we passed through in this cross-cut. The stone he is getting out shows gold in sufficient quantities to pay good dividends when the machinery is erected. The boiler is being set, having borne a pressure of 80 lbs. to the square inch; I think the pressure might have been doubled without injury to the work.—Central Mine: I have commenced operations at this mine. The Government are carrying out a system of water supply, and near our mine excavated a large quantity of stone fit for building purposes. I applied to, and obtained leave from, the Mining Department to use the stone they had quarried, thereby saving some hundreds of pounds to the company. The securing a supply of stone, and making a road for the proper approach to the shaft, are all I have done here for the present. Advertisements are inserted in the local newspapers, calling for tenders for the erection of the buildings, and I will give you the result in my next."

SCOTTISH AUSTRALIAN.—The directors have advices from Sydney to Jan. 1, with reports from Lambton Colliery to Dec. 29. The return of the coal sales for the month ending Dec. 31 had not been completed at the date of the despatches, but the assistant-superintendent writes that the Lambton Colliery was getting a fair share of the coal trade, and that the quality of the coal continued very good.

ENGLISH AND AUSTRALIAN COPPER.—Port Adelaide, Jan. 6: There were five furnaces at work at Port Adelaide—three smelting, two roasting, and one refinery. The company's operations were proceeding satisfactorily.

FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho produce for December, 8387 oits, from 5229 tons of ore; yield, 1·603 oits. per ton. Morro Velho cost for December, 4910*l.*; loss for ditto, 1662*l.* Morro Velho produce, 11 days of January, 3064 oits.; yield, 1·767 oits. per ton. Gaia produce for December, 1178 oits., from 820 tons of ore; yield, 1·436 oits. per ton. Gaia cost for December, 450*l.*; Gaia profit for ditto, 68*l.* Gaia produce, 11 days of January, 477 oits.; yield, 1·595 oits. per ton. The Morro Velho produce for the first division of January, it will be seen, is a considerable improvement compared with the first division of December, and other divisions since. The yield per ton in the General Stamps is the best we have had for several months.

DON PEDRO.—Mr. Symons reports—"Produce, 21,499 oits.; profit, 6789*l.* 1s. 6d. The works have been carried on in the usual manner. Good duty done, and the work excavated from the general stopes yielded well. A little box work, not rich, has been excavated, though absence of this in so good a return satisfactorily proves in this, as in former months, the high yielding standard of the general lode at Maquine. The exploratory works have been pushed on with, but nothing new has been discovered. At the shallow adit the ground continues bad, and no progress was made. With average ground it would take a long time to drive what remains to be tunnelled, and a heavy cost be incurred; this has been taken into consideration, together with the fact that from the nature of the ground runs might occur, and endanger works at surface. Since Capt. Treloar has been here other measures have been under consideration that will supersede the said adit. Works connected with pumping machinery to be adopted have been pushed on with. At the deep adit force has been increased, and it will be kept fully manned, day and night.—First division of January: Produce weighed to Jan. 17, 8399 oits. Operations are progressing satisfactorily. Good duty done, and ore sent from the mine of first-class quality, though no box work has been taken out since my last. The shallow adit has been suspended. Nothing new in exploratory works. Works in connection with pumping machinery are being pushed on. The deep adit is progressing; ground wet."

ANGLO-BRAZILIAN.—Mr. Symons reports—"Produce, 3266 oits.; loss, 144*l.* 9s. 9d. In the appearance of the lodes at most of the places in progress little or no change to note has occurred since they were last reported on. Killas is plentiful in Dawson's canoa, Haymen's Mina Grande, and the deep adit, but the dimensions of the lodes at these points are favourable, and so long as this continues an amelioration may take place from one day to another. In the stopes from Dawson's shaft the auriferous quality of the lode has further improved, but at this point also killas is appearing. In January the sinking of Foster's shaft will be resumed.—First division of January: The features of the lodes at the various sections are much the same as when last reported on, excepting in the stopes from Dawson's shaft, where the lode is becoming more disordered by killas. At Foster's west communication has been effected to the old workings above—Mina de Crimmosi—thereby affording better ventilation. The sinking of Foster's shaft has been resumed."

ROSSA GRANDE.—Mr. Hilcke reports—"Produce, 958 oits. The operations generally proceeded satisfactorily, and considering the unfavourable weather, and the small attendance of force, good duty has been performed. The Albert stamps crushed 119 tons of ore, yielding 612 oits., and the Alexandra stamps crushed 83 tons, yielding 346 oits. For clearer explanation, the hitherto so-named top level will henceforth be called the 30, and the main and western level the 40. The features of the lode throughout the mine have maintained their good appearance, and that in the 40 east has improved very encouragingly, and likewise west the lode is of a larger size and stronger appearance than it has ever been before in this place. From the 30 and the 50 we had our main supply of stone; the lode in these places yielded well: it gave an average percentage of 6·4 oits. per ton. The lode in the stopes between the 30 and 40 has diminished in size. The operations on the lode at the summit of the mountain called Mina Alto is for the time under suspension, owing to the bad weather. The stone extracted in the beginning of the month yielded 2·44 oits. per ton: 85 tons of stone have been treated from this place, and yielded 207 oits.—First division of January: With the exception of the lode in the 50, which is getting disordered and split up in small branches, little alteration has taken place in the appearance of the lode at other points in progress to call for any notice."

TAQUARIL.—Dr. Birt (Sabara, Jan. 13) writes—"Since Dec. 26 all has been going on as usual. On Jan. 1 J. Andrews, also J. Tyacke, two English carpenters, commenced their work. The former is working at the axle for our pumping wheel; the latter has been occupied chiefly in making the water pipes, tank, &c., for the water blasts of the new smithy. John Hitchins, an English smith, came also at the same date, and is daily employed at a forge in the new smithy, which, I am pleased to inform you, is nearly completed. Since I last wrote we have had fine weather—from the 31st up to this date, and this has enabled me to push on our works. I have now nearly 70 Brazilian labourers employed, and ten Englishmen, one Russian, and one North American. The deep adit goes on but slowly, on account of the hard nature of the ground to be driven; all are hoping that an improvement in this respect will shortly take place. The adit for the pumping rods is going on very well, but requires to be timbered throughout, and this is being done in a very strong and efficient manner. About 38 fms. have been completed; about 22 remain to be done, and this may be expected to be finished by the end of February. The deep shaft is now about 29 fms. deep, and the ground is favourable for sinking. The Englishmen's two houses are nearly completed, and would have been quite had we not been delayed by the extremely wet season, which prevented their manufacturing a sufficient number of tiles for our wants. These last dry days have, however, helped us in this respect, and all is proceeding as well as we can expect. I dispatched a troop of animals from this place on the 28th ult. for the purpose of conducting Mr. Richards and party up the country to Minas. I fear they will find the roads in a terrible condition, but patience only is required to end this inconvenience."

SAO VICENTE.—The company's superintendent (Brazil, Jan. 17) writes—"On Jan. 4 and 5 Capt. T. Treloar inspected both this mine and the Jacotinga formation. He advises the stopping of all works at the latter place, with the exception of No. 2 cross-cut, which he thinks ought to be newly sampled all through, then to extend the cross-cut, and drive a level east and west on the bed of Jacotinga lately intersected; and at this mine (the quartz formation) to resume operations only at the eastern section, seeing that the lode in the old mine does not warrant the heavy outlay which would be required to secure the mine, and to erect new machinery. I have commenced to carry out his views, and also put a few hands to draw to surface the available iron in the old mine. With Capt. Treloar's consent, I am making the necessary arrangements for engaging a few natives for the company."

GENERAL BRAZILIAN.—Capt. T. Treloar (Jan. 12) advises that all the documents necessary for transferring the estates are ready for delivery, and that the owners are awaiting his arrival to hand the same to him.

NEVADA LAND AND MINING.—J. J. Dunne, Jan. 28: I have the canal finished, but have some work to do above the head-gates in building an embankment, where the river overflows at high water, and damages the canal. I only returned from San Francisco yesterday, and have not yet been over the tail-race. I hear that they are still at work on it, but I do not know how near finished it is. I have had the reservoi r for tailings cleared out another one that was partially built finished. I shall have to build a large one, capable of holding 20,000 tons, as by saving the tailings, and letting them lie some time, they give a handsome profit on the re-working. I can do the work much cheaper in the winter, while the ground is soft, but will not undertake it at present, as I want to get along at as small an expenditure as possible. I leased to-day 100 acres of farming land, tenant to furnish everything, and give me one-third of the crop. I will, at the same time, sow hay seed (Timothy and clover), so that next year it will give a crop of hay.

PERDU CARTA Y ANDRIA (Sardinia).—A communication from the agent, Mr. Nonnis, dated Feb. 19, announces that the silicate of zinc deposit had been cut, and that it had much improved the returns, the quantity of calamine cubed since the 4th being 58 cubic metres, equal to 101 tons, all over 43 per cent. for zinc. This will give the company a return of over 200 tons per month.

VAL ANTIGORIA.—Thomas Roberts, Feb. 14: The end south from winze, under the 20, on No. 2 lode, has been driven 5 metres. The lode in this drivage varied in width from 9 to 5 in., but in the bottom of this level it is now of a greater width, and contains much more pyrites, which has induced us to discontinue driving south and return back to sink the winze deeper. The lode in the winze is poor at present, but we expect a change for the better in a few metres sinking. We have recommenced driving north on No. 2 lode, in the 20; the lode in this end bids fair for an improvement shortly. In clearing an old level west of the Alfonzo we have discovered a winze full of water; by sounding we find it 11 metres deep.

PESTARENA UNITED.—Thomas Roberts, Feb. 14: The severe cold weather, with ice, at this mine continues to make very much against the floor hands in preparing ore for the mills. The accumulation, and at times the breaking up, of ice in the water-courses interferes also with the working of the machinery. At present we are working 74 small mills at Pestarena. Under these circumstances, which we cannot this season of the year guard against, and this month being short, our gold produce for February will at Pestarena be less than January. At Battigio the weather is more favourable. Nothing new at the Cani Mine. At Val Toppa we are going on much as as usual. The new lode in two of the ends driving never looked better than they do at the present time.—Aquavite; We are pleased to state that the end of the 46 south is gradually improving; we estimate it to be worth 3 ozs. of gold per fathom. The lode in the 23 fm. level end south yields 2 ozs. per fathom. The stopes in the bottom of this level, near the whim-shaft, is now worth 5 ozs. of gold per fathom.—Peschiera: Here we have, by means of the water covering the 75, been hindered some days from working in the bottom stope this month, in consequence of some small breakages to the pumping-gear. The lode in the end of the 70 north yields 3½ ozs. of gold per fathom. The stope in the bottom of the 46 yields 3½ ozs. per fathom. The lode in the end driving south under the slide, in the 16, is not looking so well. The stopes in the bottom of the adit, near the boundaries of Peschiera and Aquavite, yield 5 ozs. of gold per fathom. No change to notice in other points not mentioned.

LUSITANIAN.—Feb. 16: In sinking Taylor's engine-shaft below the 120, and stoping above the 110, the lode is worth 2 tons per fathom. At this point the caunter lode has formed a junction with Basto's, but has made no improvement. In sinking No. 77 winze, below the 110, the winze has gone through a lode, worth from 3 to 5 tons per fathom. In sinking River shaft, below the 100, east of Taylor's, the lode is composed of flookan; this shaft need be sunk for the convenience of drawing to assist Taylor's.—Levels on Basto's Lode: In the 120, east of Taylor's, the lode is worth 3 tons per fathom. In the 120, west of Taylor's, the lode is worth 1 ton per fathom. In the 110 east the lode is worth ½ ton per fathom. In the 110 west the lode is 2 ft. wide, composed of quartz and stones of ore. In the 90, east of River shaft, the lode is 1½ ft. wide, composed of flookan. In the 70, east of ditto, the lode is 1½ ft. wide, composed of flookan.—Stoping above the 80, on Caunter Lode: In the 38, west of Perez' shaft, the lode is 1 ft. wide, and produces stones of ore.—Levels on Branch: In the 8, west of Perez' shaft, the lode is worth 1 ton per fathom. In the adit level, west of Perez' shaft, the lode is worth ¾ ton per fathom. In the 28, east of the slide, on Ponte lode, the lode is 9 in. wide, composed of quartz, spotted with mundic. The ground at the various cross-cuts is composed principally of hard gneiss.—Carvalhal: In sinking Incline shaft below the 40 we do not find any lode to value.—Levels on Great Lode: At the 40, west of Incline shaft, the lode is 3 ft. wide, composed of quartz, containing lead and blende, worth ⅛ ton per fathom. In the 30, east of ditto, the lode is 4 ft. wide, and worth 2 tons per fathom for blende. In the 20 east the lode is split into branches, which contain lead, worth ½ ton per fathom. In the 10 east the lode is 4 ft. wide, composed of quartz and country, with good stones of lead. In the adit level, west of Incline shaft, on caunter lode, the lode is 1 ft. wide, and worth nearly 1½ ton of lead per fathom. In the 10, west of ditto, the lode is 8 in. wide, composed of quartz and mundic. In the deep adit, west of River Caima, on the north lode, the lode is 20 in. wide, composed of flookan and quartz, which has yielded some fine stones of lead and blende.

IMPERIAL SILVER QUARRIES.—Lewis Chalmers, Jan. 25: Ten feet of tunnel were made last week. I also append for your information a note of the rate of running in several of the more prominent claims both here and at Monitor and in Silver Mountain, and have much pleasure, while doing so, in directing your attention to the fact that the running in the Imperial compares very favourably with the best of them, especially when it is borne in mind that the Forest Belt and Michigan have been run mostly in picking rock; and that, with the exception, perhaps, of the Mountain, no such unmanageable stuff has been encountered as I have had to deal with since Nov. 8 last. It is quite different in character from anything in the neighbourhood—as a rule, drilling badly, and blasting worse. During the time I have run by day work I have widened, heightened, and re-laid the track in 180 feet of old tunnel, put in 670 feet of ventilating pipe, 58 feet of ventilating chimney, cut 490 feet of drain, 12×18 inches, and done a considerable amount of grading for house and office and blacksmith's shop; and I have only to add that what has been done is acknowledged by all who have seen it to have been done well.

RATE OF RUNNING IN DIFFERENT TUNNELS IN ALPINE COUNTY, CALIFORNIA.

	Size of tunnel.	No. of shifts.	Ft. per week.
Pittsburgh	4½ × 6½	2	7
Pennsylvania	5 6½	2	5⅛
Mountain	6 6½	2	5
I. X. L. Main Tunnel	4½ 6½	3	8
,, Lower (along soft casing)	4½ 6½	2	10
Illinois (Pilkington)	5 6½	2	8
Wide West	6 7	2	9
Globe	5·8 6½	2	6
Michigan (Indian Chief, &c.)*	6 7	2	12·10
Forest Belt (Scottish Chief, &c.)†	5·8 6½	2	9·6
Mount Bullion‡	5·8 6½	3	10
Imperial (contract of 150 ft.)	6 7	3	10½
,, (three shifts)	6 7	3	11
,, (two shifts)§	6 7	2	9·2¼
Mount Bullion (day Coulter)	5·8 6½	2	9

* All picking. Rock of the very best description. Cost about $8 per foot, according to the foreman.

† Half picking and half blasting. Good working rock. Log cabin and shop erected during this running. This mine stopped working Jan. 16.

‡ See contractor's partner (G. Low's) letter, proving that during the latter part of the contract they were able with three shifts to make only 9 ft. 7 in. per week.

§ Towards the expiry of this contract the running got so bad that the men left the contractor, and he had to abandon the contract; and I finished it, at a cost to him of $20 per foot, and could not let another contract, unless on the most exorbitant terms. Same with Mount Bullion Company.

CAPE COPPER.—John Williams, Jan. 7: Ookiep: The engine-shaft has been sunk 2 fms. during the last month. We have 2 fms. 2 ft. more to sink to complete the lift to the 40, at 45*l.* per fathom. The 30 south, west from engine-shaft, has been extended during the past month 3 fms., 10 ft. through a very hard, unproductive quartz rock; re-set, Jan. 1, to two men and two labourers, at 30*l.* per fathom, for 1 fm. or the month. The 30, north from engine-shaft, has been extended 3¾ fms. during the past month, in a very good course of copper ore; it is unproductive, and we have suspended this end for the present, and put the men on the stopes, in place of those who had left, to assist in raising ore. The 30, west from engine-shaft, has been extended during the past month 2 fms. 4 ft. 8 in., in a good copper ore, but is not looking so good at present, having met with a hard floor of quartz rock, which I think we shall soon get through, and find ore the other side again; re-set, Jan. 1, to three men and three labourers, at 25*l.* per fathom, for 3 fms. or the month. The winze in the 30 has been sunk during the past month 4 fms. 2 ft. 9 in., in a very good course of copper ore; it is now 8 fms. 3 ft. 3 in. below the 30, and will yield about 6 tons of rich ore per fathom. We shall commence driving the 40, towards the engine-shaft, from the bottom of this winze, by the end of next week, if not prevented by an increase of too much water. The 20, west from engine-shaft, has been extended only 6 in. during the past month, owing to the contractor's decease: he went into his end soon after blasting a hole, and fell down speechless, and died within an hour after. Re-set, Jan. 1, to two men and two labourers, at 30*l.* per fathom, 1 fm. or the month. The 20, east from south level, has been extended east during the past month 1 fm. 1 ft. 8 in., through very kindly ground, which has produced some good stones of copper ore; re-set, Jan. 1, to one man and one labourer, at 12*l.* per fathom, for 2 fms. or the month. No. 2 winze has been connected with the 30. The men are now engaged stoping from the back of this (the 30), at 6*l.* per cubic fathom; it will yield about 6 tons per fathom. The 20, north from engine-shaft, on the flookan course, has been extended during the past month 2 fms. 0 ft. 6 in., without any change in the ground to notice; re-set, Jan. 1, to one man and one labourer, at 10*l.* per fathom, for 2 fms. or the month. The 20, driving east from the flookan, in Job's branch, on the mineral course the incline tunnel was sunk on, has been extended 2 fms. 4 ft. 4 in. during the past month, in very kindly ground; we have a small leading branch in the north wall, from 1 to 2 in. wide, of very rich copper ore; re-set, Jan. 1, to one man and one labourer, at 10*l.* per fathom, and 2*l.* per ton for copper ore of 30 per cent. The stopes in the back of the 20 are looking very well; they will yield about 7 or 8 tons of copper ore per fathom. I am pleased to remark that all the labourers in each department are working satisfactorily. December extract, 551 tons of 2240 lbs., or 525 tons of 2352 lbs.; average per cent., 34.

LINARES.—Feb. 16: West of Engine-Shaft: The lode in the 110, driving west of St. Tomas engine-shaft, is small and poor. The 85, west of Warne's engine-shaft, is worth 1¼ ton of lead ore per fathom; the lode is very open, consisting of calcareous spar and lead ore. In the 85, east of Warne's shaft, the lode is large and strong, yielding 1 ton of ore per fathom. The 45, east of San Francisco shaft, produces 2 tons of lead; this end is opening a good length of tribute ground. The lode in the 31, east of San Francisco shaft, is very compact, consisting of quartz and lead ore, and yielding of the latter 1 ton per fathom.—East of Engine-Shaft: The 95 fm. level, east of Taylor's cross-cut, is worth ⅛ ton per fathom; the lode is very wide, and is spotted throughout with lead. The lode in the 95 fathom level, east of Taylor's shaft, is large and strong, yielding stones of ore, but not enough to value.—Shafts and Winzes: San Francisco shaft, sinking below the 31 fm. level, is worth 1 ton per fathom; the lode is getting a little more compact and regular. No. 165 winze, below the 75 fathom level, yields 1 ton per fathom; this new winze is situated 36 varas west of Warne's engine-shaft, and will be pushed down to the 85 with all speed.—Quinientos Mine: The 32, driving west of Taylor's engine-shaft, is worth 1 ton of ore per fathom; the lode is of a kindly appearance, and is comparatively easy for driving. The lode in the 32, east of Taylor's engine-shaft, contains good stones of ore. In the cross-cut south from Cox's shaft the ground is rather hard for driving.—Shafts and Winzes: In Taylor's engine-shaft, sinking below the 32, the sumpmen are making moderate progress. San Carlos shaft, below the 20, yields 2 tons of ore per fathom; the lode is large and strong, and of a kindly appearance.

ALAMILLOS.—Feb. 16: The lode in the 4th level, east from La Magdalena shaft, is small and poor. The 5th level, east of above shaft, yields ¾ ton of ore per fathom. The lode has been very poor, but is now improving. The 5th level, west of La Magdalena shaft, is worth 1¼ ton per fathom; the lode looks well, and is opening good tribute ground. In the 5th level, east of Taylor's engine-shaft, the granite is hard for driving through. The lode in the 6th level, east of Taylor's engine-shaft, is large, and spotted with lead. The ground in the 5th level, west of Taylor's shaft, is hard—lode unproductive. In the 6th level, west of Taylor's shaft, the lode is more defined—very large, with plenty of water. The 4th level, west of San Andriano shaft, is unproductive. In the 3d level, west of San Yago shaft, the lode has slightly improved, being spotted with lead ore. In the 2d level, east of Cox's shaft, the lode, which yields ½ ton of ore per fathom, has decreased in size, but is still very large. The 2d level, west of Cox's shaft, is worth ¾ ton of ore per fathom; the lode is a little smaller, and the ground harder. No change has taken place in the 2d level cross-cut, north of Judd's shaft. The 3d level, east of Crosby's shaft, yields ½ ton per fm.; the lode is small and the ground hard. In the 2d level, east of Henty's shaft, the lode is very small and poor; and the 2d level, west of Henty's, is of a very similar character.—Winzes: Tomas' winze, sinking below the 4th level, yields ½ ton of ore per fathom; this has reached the depth required. Agueda's winze, below the 4th level, yields 1 ton of ore per fathom; the lode has failed a little both in size and value. Prim's winze has reached the required depth; the lode is worth ½ ton per fathom. In Guirado's winze the lode is very regular, but is at present poor. The lode in Grandi's winze has a good appearance, and is worth 1¼ ton of ore per fathom.

FORTUNA.—Feb. 13: Canada Incosa Mine: The 100, driving west of Henty's shaft, yields ½ ton of ore per fm.; the lode is split into branches, containing good stones of lead ore. The 90, west of Judd's, is worth 1½ ton per fathom; the lode, although a little smaller than it was, is still opening good tribute ground. The 80 fm. level cross-cut, south of Henty's, is hard for driving. The lode in the 90, east of Addis's shaft, is strong, and hard for driving, consisting chiefly of quartz and carbonate of lime. The 70, east of Carro's shaft, is worth ¾ ton of ore per fathom; the lode is small, and the ground hard for driving. In the 50, east of San Pedro shaft, the lode is large and strong, producing 1 ton of ore per fm.—Shafts and Winzes: In Henty's shaft, sinking below the 100, the men are cutting plat, and fixing penthouse, and will resume sinking in a day or two. Lowndes's shaft, below the 75, is worth 1 ton of ore per fathom; this will be completed to the 80 in the present month. In Pigueno's winze, below the 70, the lode, which yields 1 ton of ore per fathom, is small, and the ground is hard. Prueba's winze, below the 70, yields 1 ton of ore per fathom; the lode is somewhat disarranged in this winze and is not so productive as it was. Primera's winze, below the 80, produce, 1¼ ton of ore per fathom; tde lode is improving, and going down in a very promising piece of ground. Avirar's winze, below the 110, is worth 1 ton of ore per fathom; the lode is still large and strong, but not so productive as it was.—Los Salidos Mine: In the 100, west of Morris's engine-shaft, there are small veins of ore, but not sufficient to value. The driving of the 90, west of Buenos Amigos shaft, is resumed; the lode at present is small. The 75, west of Buenos Amigos shaft, produces 1½ ton of ore per fathom; the lode here is looking better than usual. The 100, east of San Gabriel shaft, produces 1½ ton of ore per fathom; the lode is large and kindly, but not so productive as it was. In the 90, east of Cox's shaft, the lode is strong and regular, producing 1¾ ton of ore per fathom; the groung is rather hard for driving. The 75, east of San Pablo's shaft, is worth 2½ tons of ore per fathom; this end is passing through a valuable run of ore ground.—Winzes: Tomas' winze, sinking below the 65, yields 2 tons of ore per fathom; this winze is holed to the 75 fm. level. Ramon's winze, below the 75, is communicated to the 90; the lode is worth 1¾ ton per fathom. The lode in Murillo's winze, below the 75, is divided into small branches, yielding ¾ ton of ore per fathom. Colon's winze, below the 90, is worth 1¼ ton of ore per fathom; this new winze is situated a little in advance of the 100 west. The tribute department yielded a good average quantity of mineral in the past month without undergoing any unusual change, and the stopes are looking moderately well for February, enabling us to estimate the raisings at 350 tons. The machinery in both mines is in very good working order, and the surface works generally are going on very regularly.

[For remainder of Foreign Mines, see this day's Journal.]

THE SLATE TRADE IN AMERICA.

The most important slate quarries and factories in the United States are situated in the Lehigh Valley, in North-Eastern Pennsylvania, about 75 miles north of Philadelphia, and 100 miles west of New York. Slatington, on the Lehigh, has been built up within the last few years, exclusively by the slate establishments in its vicinity. Within a radius of 25 miles from that centre there are probably 50 slate quarries, giving employment to hundreds of hands, and to large amounts of capital. A good slate quarry, with a few acres of land, sells there at from 5000*l.* to 15,000*l.*; some have realised considerably more than that. The estimated annual value of these quarries in roofing slate is from 150,000 to 200,000 squares. It sells, and pays, at about 30s. per square, free on the railway truck, and, in New York and Philadelphia, is 8s. or 9s. per ton higher. Slate is rapidly superseding all other kinds of roofing throughout the district. It costs but little more than the first quality of cyprus shingles, while it is fire-proof, and lasts for ages. There are regular slate houses in Chicago, Cincinnati, and St. Louis, as well as in Baltimore, New York, and Boston, and in all the cities on our Atlantic coast. Nearly all the school slates used in the United States are made in the Lehigh Valley. The slates are cut out with great rapidity, with 6-in. circular saws, propelled by steam or water, and are smoothed off by hand with a short and thick drawing knife, called a slate-scraper. One hand will cut out 1000 in a day, and other will smooth off 500. The frames are all made by machinery, of seasoned cherry plank, and cost about 2 cents. each. School-slates, and all manufactured work, pay better than roofing and flagging. There is not, to my knowledge, a single manufactory of school-slates in the entire South.

An effort is now being made by Mr. Baldwin, the owner of extensive quarries at Amherst, Virginia, to remedy this deficiency, by bringing the Amherst slates into the market; and as he is satisfied that he can produce them 25 per cent. cheaper than in the Lehigh Valley, he confidently anticipates success. The number of school slates made near Slatington is immense. The slates are packed in neat cases, and consigned to the wholesale houses in large cities. Slate pencils are made in the United States only in Vermont, where a single factory, it is said, turns out by machinery 100,000 a day. The Amherst slate has proved itself well adapted to this purpose. Besides school slates, the Lehigh factories send out an immense number of mantel-pieces, billiard, bureau, table, counter, and wash-stand tops, foot and bathing tubs, refrigerators, chess and backgammon boards, brackets, registers, sinks, &c. Even coffins, which will last as long as the earth itself, are now made of slate, which is almost daily applied to some new purpose. The mantels are shaped and polished at the factories by expensive machinery, and are then sent to the cities, where they are elaborately painted with mineral paints, in imitation of the antique marbles, and subjected to a high heat, which transfuses and infixes the colours in the grain of the slate as thoroughly and permanently as if they had been painted by Nature itself. These slate mantels are said to be stronger and more durable than marble, as well as cheaper and prettier; they are at present coming into extensive use.

There are many varieties of slate—argillaceous or clay, like the Lehigh or Amherst slates—the best for economical purposes—talcose, like the soft slates of Albemarle, which are unsuitable for roofing—micacious, which are fire-proof, &c. Many large beds of slate, "so-called," are found in Rockbridge, but being deficient in the oxide of iron, which composes 10 or 12 per cent. of good roofing slate, they want durability, and soon crumble into shale when exposed to the weather. They are good for nothing for working purposes. Slate is of many colours—grey, blue, black, green, red, and purple, with all intermediate shades. The red and green slates, which are considerably used in the North for churches and other fancy buildings, come from Vermont. They sell at about 2*l.* 12s. a square in New York. Good slate lies in the earth, in all positions, from horizontal to vertical. It is often found in narrow veins between other rocks. Working slate is rarely, if ever, found nearer the surface than from 10 to 30 ft., and generally gets firmer as you go deeper. Some of the old quarries are several hundred feet deep, and have to employ expensive steam-engines to pump the water. There appears to be only one quarry in Slatington having natural drainage—a steam-engine costs nearly 200*l.* per annum to run it. The slate is quarried by blasting with light charges of powder. It is then hammered into square or oblong blocks with heavy and sharp stone axes, and split into thin sheets with broad and thin steel chisels while green and fresh from the quarry; it will not work when dry. A set of four miners—two quarrymen, one dresser, and one splitter, called a "block"—will get out about 10 squares a-day in a first-class quarry. It is sometimes got out by contract by the square—about 10s. per square appears to be the amount paid.

Nearly all the slate quarrymen in the United States are Welshmen, who speak the Welsh language and imperfect English; their wages range from 12s. to 16s. per day. Unskilled labour, lumber, fuel, provisions, house rent, and water-power are much lower in the Amherst district than in the Lehigh Valley, while the milder climate is far more favourable for quarrying, hauling, and all out-door operations. Some of the Lehigh slate quarries and factories are conducted by individual owners, some by leases, and the larger ones by partnerships and incorporated companies. The leases of unimproved quarries are on all sorts of terms and conditions, and run from 10 to 99 years. The royalty ranges from 25 cents to $1 per ton, making three squares of roofing slate. A few of the best establishments pay an annual profit of from 30 to 50 per cent., but this is much above the general average. The Buckingham (Va.) Slate Company, composed of efficient Northern men, working a single narrow and deep quarry, kept dry by a steam-engine, and hauling their slate in wagons four miles to the canal, have recently declared a dividend of 12 per cent. for the last year on a capital of about 10,000*l.*, after providing some 600*l.* for a new steam-engine, and stocking 3000 squares of roofing, which they are exporting to New York and Boston—a result showing admirable management and very large profits. Yet the Buckingham Company make nothing but roofing slates and flagging, whilst the Amherst slate is equally adapted for roofing, school slates, and all other economic purposes for which slate is now employed.

THE MANUFACTURE OF WATCHES AND CLOCKS.—A most interesting and instructive little work, describing briefly, but with great clearness, the rise and progress of watch and clock making, has just been published by Mr. J. W. Benson, of 25, Old Bond-street, 99, Westbourne-grove, and the City Steam Factory, 58 and 60, Ludgate-hill. The book, which is profusely illustrated, gives a full description of the various kinds of watches and clocks, with their prices, and no one should make a purchase without visiting the above establishments or consulting this truly valuable work. By its aid persons residing in any part of the United Kingdom, India, or the Colonies, are enabled to select for themselves the watch best adapted for their use, and have it sent to them with perfect safety. Mr. Benson, who holds the appointment to the Prince of Wales, sends this pamphlet to any address on receipt of two postage stamps, and we cannot too strongly recommend it to the notice of the intending purchaser.

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